# CYCLES

## - A MONTHLY REPORT

SEPTEMBER · 1950

ONTARIO FISHERIES
RESEARCH LABORATORY

FOUNDATION FOR THE STUDY OF CYCLES

*Riverside, Connecticut*

# THE SIGNIFICANCE OF THE SEPTEMBER REPORT

Here at Foundation Headquarters we refer to the memoranda in our monthly report as "stories." Why did we select the 12 stories in the present issue? What is their significance?

The **Director's Letter** was, of course, included to give you general orientation, with particular reference to the possible effect of the war upon the cycles.

The **General Electric story** was included because it gives you details of an excellent example of the 6-year rhythm as it appears in the figures of a very important individual manufacturing concern. You need to know a great deal more about this cycle. You will hear of it often in future reports.

The **sunspot story** is important because it shows for the first time in print that there really is an 18-year **rhythm** in sunspots with alternate cycles reversed. C. N. Anderson showed that **on the average** waves of seventeen and a fraction years and waves of eighteen and a fraction years have important size. His work gives us a **hint** that there may be rhythms of about

(Continued on inside back cover)

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CYCLES--A Monthly Report is published by the Foundation for the Study of Cycles every month except during July and August at the Foundation's offices at 9 East 77th Street, New York 21, N. Y. Subscription rates $10.00 a year. Application for entry as second class matter at New York, N. Y. is pending.

Vol. 1 September • 1950 No. 2

# The Director's Letter

Dear Member:

The Post Office Department will not give us a second-class mailing permit if we continue to call this publication **The Director's Letter**. We have therefore changed the name to **Cycles--A Monthly Report**.

Are you keeping a file of these releases? If so, for the sake of uniformity, you might wish a cover for the June issue with the present name instead of the old name. Such covers, on blue stock, will be sent free on request. You can tear off the old cover and, in its place, slip on the new one.

## WAR

What will the war do to the cycles? No general answer can be given. Some of the cycles will be modified or disrupted; some will not.

For example, you will remember that in World War I and in World War II the 33-month rhythm in the ton-miles of the Canadian Pacific Railroad was completely disrupted (refer to our release of February 8, 1950). On the other hand, the 9.18-month rhythm which is also present in these same figures persisted through both wars without especial distortion, as I shall show you in a forthcoming Report.

During past wars many price and production rhythms were completely disrupted, if not in timing, at least in amplitude.

On the other hand you will find that some financial series, such as the stock market, show no evidence of having been distorted except momentarily. In fact, in February 1898 when the Spanish-American War started, or September 1939 when World War II began, or December 1941 when Pearl Harbor was attacked, no distortions in the monthly figures are visible at all (for stock market behavior since January 1901, see charts on pages 12 and 13). At the beginning of World War I and at the beginning of the Korean War there were, it is true, sharp declines, but who knows whether these declines were the result of the war, or were the result of other forces, perhaps cyclic, perhaps not, which were merely 'triggered' by the beginning of hostilities? No one will really know until we discover all the cycles involved, and can thereby determine the effects of sporadic non-cyclic forces.

## FUTURE RELEASES

You will presently receive Foundation Reprint No. 32, Biological Rhythms and Cycles, by Dr. Nathaniel Kleitman of the University of Chicago. Following that we have another important reprint up our sleeves.

The present issue of **Cycles—A Monthly Report** contains 32 pages, and a four-page cover. With your active financial support we should be able to continue at this rate throughout the coming year.

Very cordially yours,

Edward R. Dewey

Director

# Research

## THE 6-YEAR RHYTHM IN ORDERS RECEIVED BY THE GENERAL ELECTRIC COMPANY

## 1893-1946

For more than 50 years the orders received by the General Electric Company have fluctuated in a rhythm of about six years in length. Through wars and depressions, in spite of changes in management, and changes in the nature of the business, the rhythm has persisted.

The average effect of this rhythm in the past has been an overall move up or down of about 30% of trend. A knowledge of it is therefore of the utmost importance to management and to investors.

Ideal timing calls for 3½ years of increase, relative to trend, after the end of 1950, but a reference to the charts shows that the actual behavior has often been distorted.

A rhythm of this length is very common in American industry. Of about thirty companies studied, it is present in the sales and production figures of about twenty-five. A rhythm of this length is

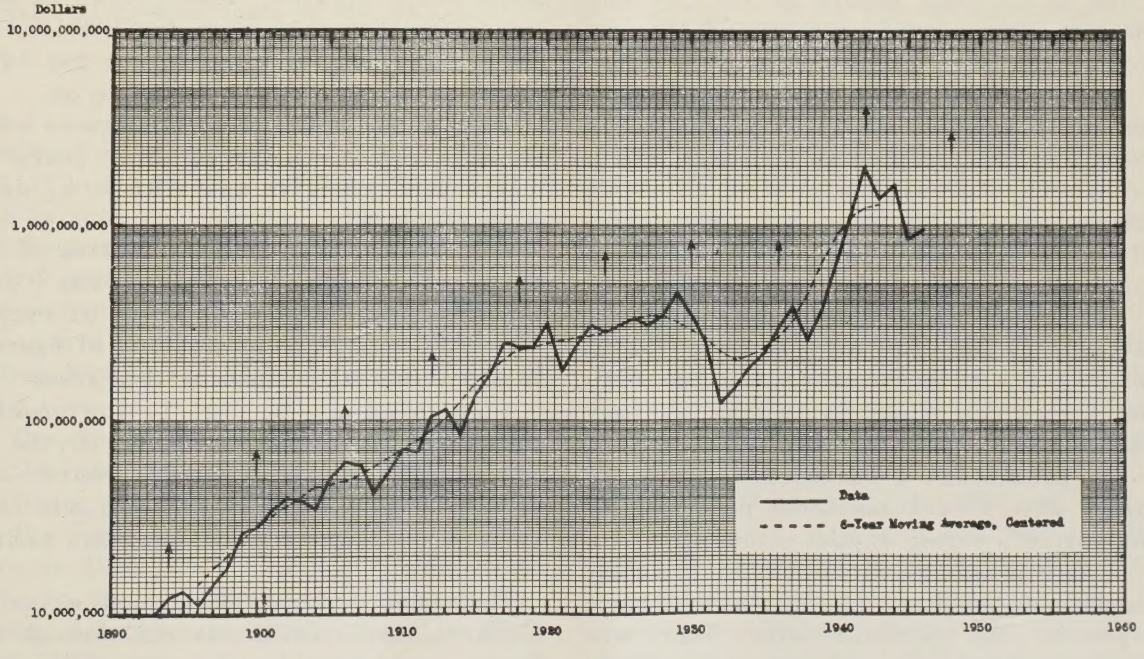


FIG. 1. ORDERS RECEIVED BY THE GENERAL ELECTRIC COMPANY, 1893-1946, AS FURNISHED TO THE FOUNDATION BY THE COMPANY, SOLID LINE. CENTERED 6-YEAR ARITHMETIC MOVING AVERAGE OF THE ORDERS RECEIVED, DOTTED LINE. NOTE THAT BY THE NATURE OF ITS CONSTRUCTION THERE ARE NO MOVING AVERAGE FIGURES FOR THE FIRST AND LAST THREE YEARS OF THE DATA. ARROWS HAVE BEEN PLACED IN 1894 AND EACH SIXTH YEAR THEREAFTER TO DENOTE TIMES OF STRENGTH, RELATIVE TO TREND. A 6-YEAR RHYTHM IS VISIBLE BY INSPECTION. (RATIO SCALE.) FOR DATA SEE PAGE 25.

present on the average in each of six one-hundred-year sections of tree ring measurements; it has been alleged to be present in the alternate thickness and thinness of rock strata; it is present in barometric pressure in New York City; it is clearly present in sunspots with alternate cycles reversed. It is a very important rhythm. It would seem to be fundamental.

All the facts in regard to the 6-year rhythm in the orders received by the General Electric Company were fully set forth in an 18-page report issued last year by the Foundation.

This report was based on figures furnished the Foundation by the company. This report seems to have attracted a good deal of attention. Orders for it have come in from all over the country. It is now out of print.

At the time of its issue this report was offered to our members free on request but only a few persons availed themselves of the privilege of obtaining it. It therefore seems a good idea to tell you something about this report at the present time, and to reproduce three of the six charts that were included in it.

Fig. 1 shows orders received by the General Electric Company by years, 1893-1946. You can see clearly by inspection a 6-year rhythm, with areas of relative strength at 1894 and every six years thereafter. To help you I have placed arrows at these years.

Once it is pointed out, this rhythm is as plain as the nose on your face. But it is a little like Columbus and the egg. Until somebody shows it to you, you may not see it.

As this point a confession may be in order. When I first saw these figures I did not notice a 6-year rhythm either.

A vice-president of the General Electric Company had told me that he had noticed a 3-year rhythm in their sales. There are indeed traces of such a rhythm (for example, start at the crest in 1917 and count forward 1, 2, 3; 1, 2, 3; 1, 2, 3; 1, 2, 3) but the 3-year rhythm is not consistent throughout the series. Annual figures are too crude to solve the mystery of the apparent 3-year behavior. Therefore, to get rid of the interference caused by the 3-year wave, I computed a 3-year moving percentage of the figures, as shown in Fig. 5.

In Fig. 5 the 6-year wave is so clear that it is unmistakable. That is, the 3-year moving percentage 'breaks' the series so that anyone can read the answer, just as Columbus' breaking of the egg showed everyone how to stand an egg on end.

Then, going back to the original series, and knowing what to look for, the 6-year rhythm was so plain that it is almost impossible to see why it escaped me at first examination.

At this point it may be well to pause to say a word about the 3-year moving percentage, just in case the term is not completely clear to you.

A 3-year moving percentage is merely the percentage that the value of each point on a curve is of the value of the point three years earlier. That is, it is the percentage that the orders for 1896 are of the orders for 1893, the orders for 1897 are of the orders for 1894, and so on.

Such a manipulation of the figures will minimize any waves around three years in length and emphasize waves of 5, 6, or 7 years in length.

For a slightly fuller description of the moving percentage, refer to Section 7 of a memorandum on how to get hints of cycles that may be present in a series of figures, in the Technical section of this issue.

Returning now to Fig. 1, the problem remaining is to make sure the rhythm is exactly six years in length, which was done by a periodogram analysis, and then to find the shape, amplitude, and timing of the wave.

To minimize trend and longer waves, a 6-year moving average was run through the figures, as shown by the dotted line in Fig. 1. Percentage deviations of the actual figures from this trend were then plotted

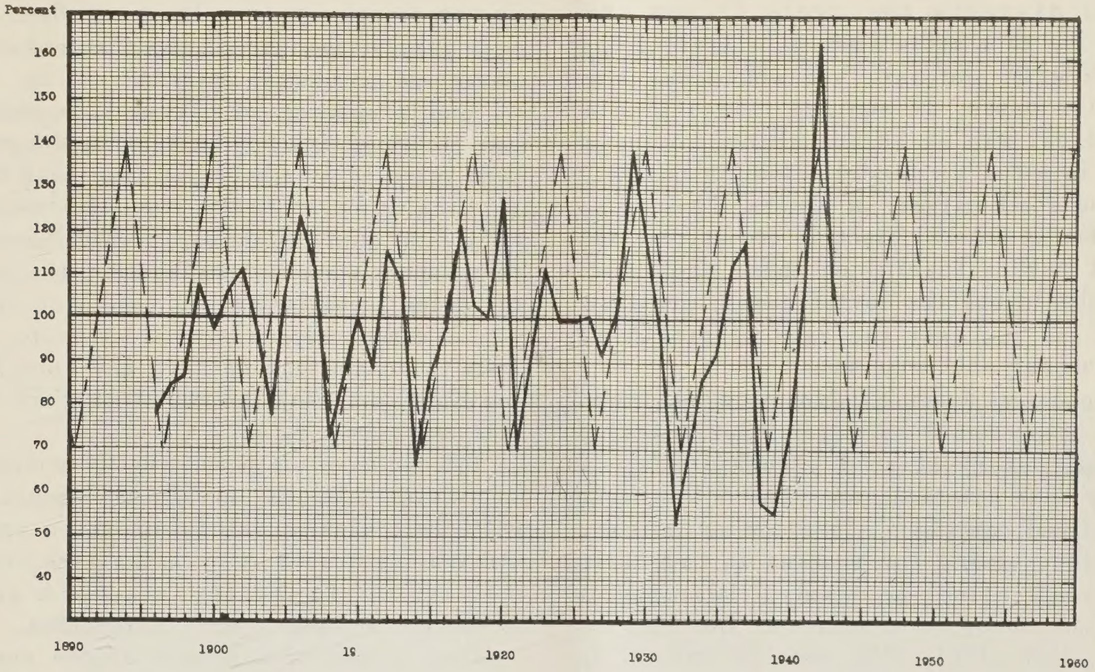


Fig. 3. The 6-year wave in General Electric Company Orders Received 1896-1943. The data expressed as percentages of their centered 6-year arithmetic moving average, solid line. A perfectly regular 6-year wave has been added by means of a broken line, to aid the eye.

The solid line curve represents the percentages that the actual data plotted by the solid line in Fig. 1 are of the corresponding points of their 6-year moving average, plotted in Fig. 1 by a broken line. In other words, it represents what we would have if we "pulled" the broken line of Fig. 1 into a straight horizontal position, and "brought" the solid line along with it.

in Fig. 3, and all the various waves averaged.

(If you feel that a 6-year moving average in some way 'created' the 6-year wave, reassure yourself by looking at Fig. 1 where you can see the 6-year wave in the raw figures, or refer to a memorandum, 'Does a 6-Year Moving Average Create a 6-Year Wave?' in the Technical section of this issue.)

The results of these calculations show us that the average or typical wave has the following characteristics:

The ideal timing, already mentioned, puts in 1948 the last crest of the ideal wave in the percentage deviations from trend, and the next ideal crests in 1954, 1960, 1966, etc.

Ideal times for lows in these figures were found to be 2½ years later than the ideal time for highs. This would put the next ideal low for General Electric orders received at the end of 1950 after which, relative to trend, new orders will increase for 3½ years, if the average patterns of the past prevail.

This time schedule applies only to the percentage deviations from trend. The effect of the great growth of the General Electric Company over the years has been to delay the crests and advance the troughs to a pattern that would have its ideal high in 1949 and its ideal low in 1950.

I hope I have not mixed you up. The earlier paragraphs refer to the time schedule that has been present, on the average, in the percentages that the actual figures are of trend. The last paragraph gives you the time schedule in the actual figures. They differ because the growth trend distorts the cycle. If you are thinking as a cycle student, comparing one cycle with another, you would use the earlier dates. If you are thinking as a practical man of affairs trying to judge what is ahead for General Electric profits, or the stock market, or general business--insofar as General Electric orders received might have a bearing on these problems, you should use the latter dates, provided that is, you feel the rate of growth of the company will continue.

However, I cannot emphasize too much that it is naive to expect the cycles to prevail every time. A glance at Fig. 1 shows that sometimes the troughs have come ahead and sometimes after perfect timing. (Perfect timing for troughs in Fig. 1 is two years after the arrows.) Distortions are the rule, or nearly so. The lows of 1896, 1908, 1914, 1932, and 1938 did, it is true, come exactly at ideal timing, but the low of 1902 was two years late, the low of 1921 was one year late, the low of 1924 was three years early, and the low of 1945 was one year late.

The low in General Electric orders received which, in the absolute figures, is ideally due in 1950 may be on time or may be distorted. No one can tell until several more years have unfolded and we can see 1950 figures in relation to the size of the figures which follow it.

You will want to know the size of this wave we have been talking about.

Expressed as an unadjusted average deviation from trend the wave has a crest 16.6% above trend and 18.25% below trend, or an average overall move of 34.75%. If you eliminate some of the extreme values that go into this average and compute the average median (which, I have proved to my own satisfaction, is always a better measure of cycle amplitude) you come up with values 12.1% above trend and 18.8% below trend, or an overall move of 30.9%.

But here again different cycles have behaved differently; either because the wave is not constant in its force or effect, or, more likely, because of the effect of other waves and accidental factors.

People understand that a life expectancy table giving men of a certain age 7.2 more years to live does not mean that their particular Uncle Harry, now of that age, will live until November, 1957. However, they cannot seem to realize that the study of cycles is analogous.

You cannot expect any one cycle to conform to an average pattern any more than you can expect any one man to conform to a life expectancy table.

The cycles of the past have not conformed to average patterns, why should people expect the cycles of the future to do so? In studying cycles we are dealing with probabilities and tendencies; not, as a rule, in any one instance, with certainties.

What is the significance of the report in regard to the 6-year pattern in orders received by the General Electric Company? To my mind it has great significance because the cycle is so clear, so uniform, and has extended over so long a time.

We have made studies of figures furnished us by thirty or more of the leading corporations of the country. The 6-year rhythm is present in most of them. But in the majority of cases the figures do not go back before 1914 and in many cases, they do not go back as far as that. In the period of time from 1914 to date you have time for only five or six complete waves.

The situation is even worse than this. Take an imaginary series of economic figures in which there really is no 6-year wave. In spite of there being no 6-year wave, there will probably have been a war peak in 1918, a boom peak in 1929, and another war peak in 1943.

Now 1929 is only one year short of 12 years, or the span of two 6-year cycles from 1918, and 1943 is only one year more than 24 years, the span of four 6-year cycles from 1918.

These three points alone, 1918, 1929, and 1943, will therefore produce three out of the five crests that might have come about as a result of a real 6-year wave. If now you have some sort of a bump about halfway between 1918 and 1929, and another bump about halfway between 1929 and 1943, a 'first postwar' depression in 1921 (three years after 1918), a big depression low in 1933 (just when a 6-year low was due), and a war-end-fall-off in 1945, you have an almost perfect 6-year wave in your imaginary series which, as we postulated in the beginning had no real 6-year wave in it at all.

You are justified in questioning the significance of any 6-year wave that has existed only from say, 1918, to date (but of course if that is as far as the figures go, you have to work with what you have).

However, if, as with General Electric orders received, you not only find the 6-

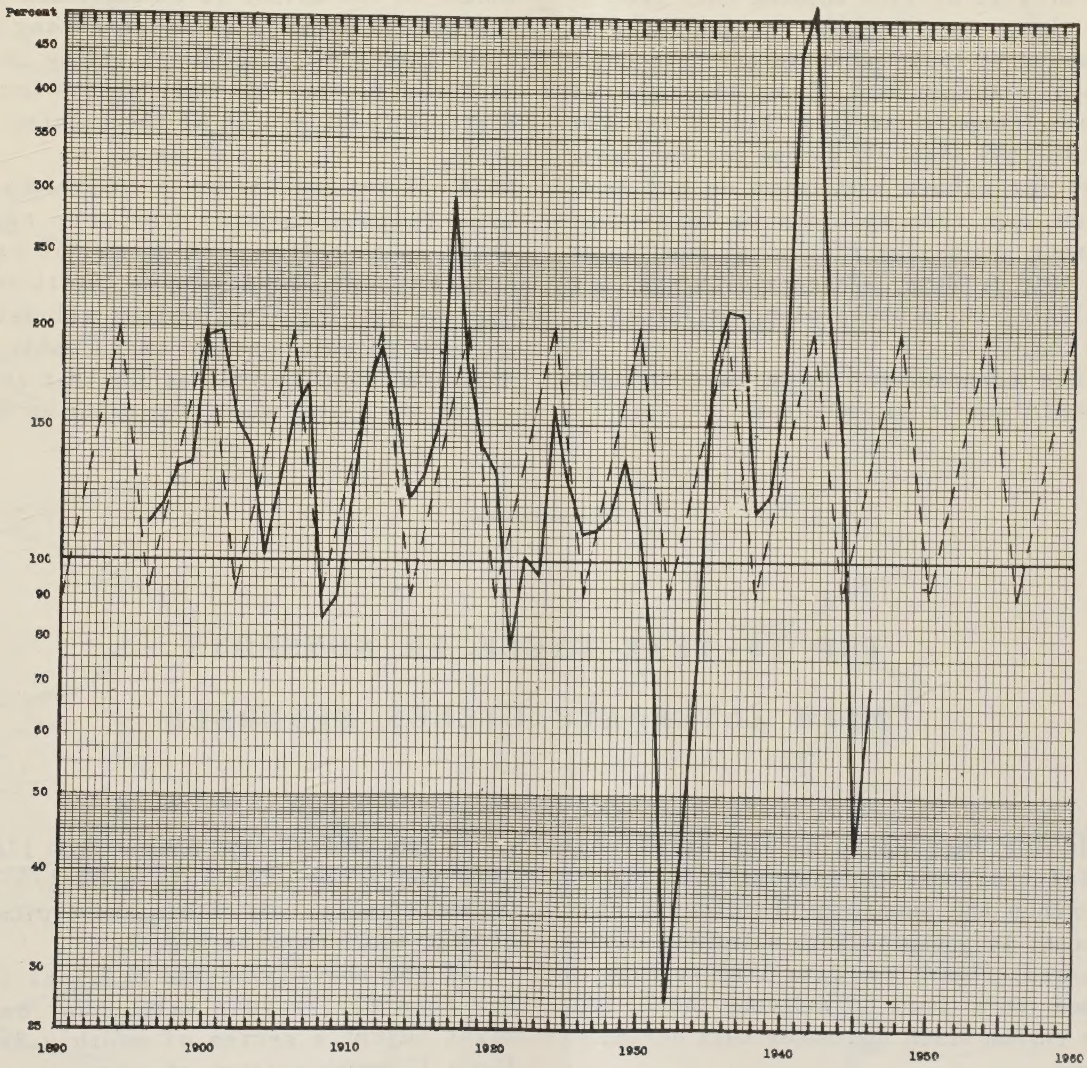


FIG. 5. THREE-YEAR MOVING PERCENTAGE OF GENERAL ELECTRIC COMPANY ORDERS RECEIVED, 1896-1946. SOLID LINE, A PERFECTLY REGULAR 6-YEAR WAVE, BROKEN LINE. EACH POINT ON THE SOLID LINE REPRESENTS THE PERCENT THAT THE VALUE OF THE POINT FOR THE CORRESPONDING YEAR IN FIG. 1 IS OF THE VALUE THREE YEARS BEFORE.

year wave from 1918 to date, but find another wave back to 1912, another back to 1906, another back to 1900, and still another back to 1894, the picture begins to take form and you see that some of the peaks and troughs from 1918 to date may not have been entirely accidental (from the standpoint of a 6-year wave) either.

And, so many economic phenomena fluctuating together as they do, when you find other shorter series which run only from 1914 or 1922 or 1925 showing this same 6-year characteristic, you are justified in wondering if they too would not have shown this 6-year pattern, like the General Electric Company, if their figures had gone back to 1893 also. Of course one can never know, for unborn companies do not have cycles, but this much can be said—that wherever the 6-year rhythm has been found from 1918 to date, and earlier figures are available, it is there also, as far as we have found.

This memorandum is now long enough. Suppose I sum it up and close:

A very important 6-year rhythm has been present in orders received by the General Electric Company from 1893 to 1946, the last year for which these figures are available. This rhythm has consisted of ten waves, clearly visible in the raw or unmanipulated figures. This rhythm has accounted for an average overall move of over 30% of trend, from crest to trough or vice versa. This rhythm is significant because of the number and regularity and number of the waves. If it continues as in the past 57 years, it is something well worth taking into account in trying to predict the future, not only of the General Electric Company, but of the country as a whole.

**Note:** If you want to buy a copy of the entire 18-page General Electric report, write in to tell me. It is out of print, but if enough people want to buy it we can reprint it. The report gives all details of wave calculation and is valuable from that standpoint as well as for what it says about the 6-year wave. The price is $2.00.

## THE 18-YEAR CYCLE IN SUNSPOTS
## WITH ALTERNATE CYCLES REVERSED

In the June issue of **The Director's Letter** I discussed sunspots with you. I described the sunspots. I told you what is meant by sunspots with alternate cycles reversed. I gave you data 1749 to date. I showed you a chart to indicate the 22 1/5-year rhythm which dominates this series of figures.

For the benefit of readers who did not see the June issue, I repeat that chart herewith as Fig. 1.

If you take all the figures from 1749 to date and throw them into a 22 1/5-year periodic table, you obtain the typical or average cycle shown in Fig. 2.

If you now adjust the original curve for this 22 1/5-year wave, just as you might adjust a series of monthly figures for a 12-month pattern of seasonal variation, you obtain the curve shown in Fig. 3. An 18-year cycle is clearly evident, but to aid the eye I have added, by means of a

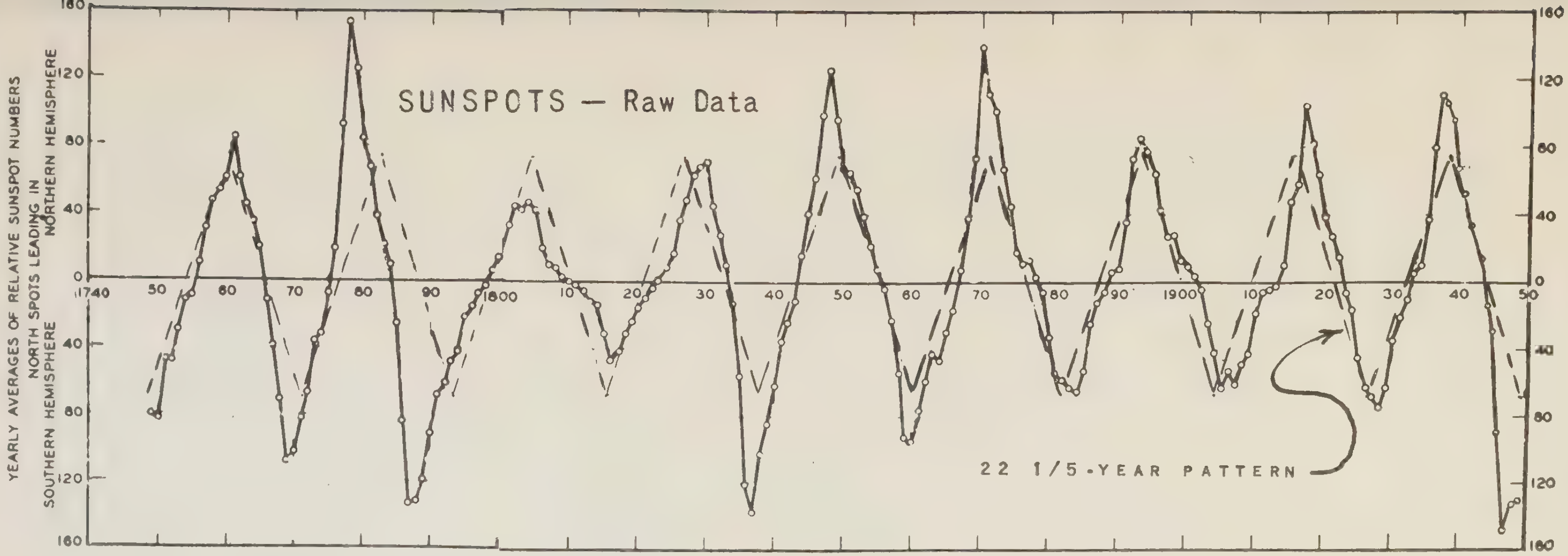


FIG. 1 YEARLY AVERAGES OF MONTHLY RELATIVE SUNSPOT NUMBERS. 1749-1949. ALTERNATE CYCLES REVERSED (AFTER ANDERSON) BROKEN LINE ADDED TO DIAGRAM THE 22 1/5-YEAR RHYTHM

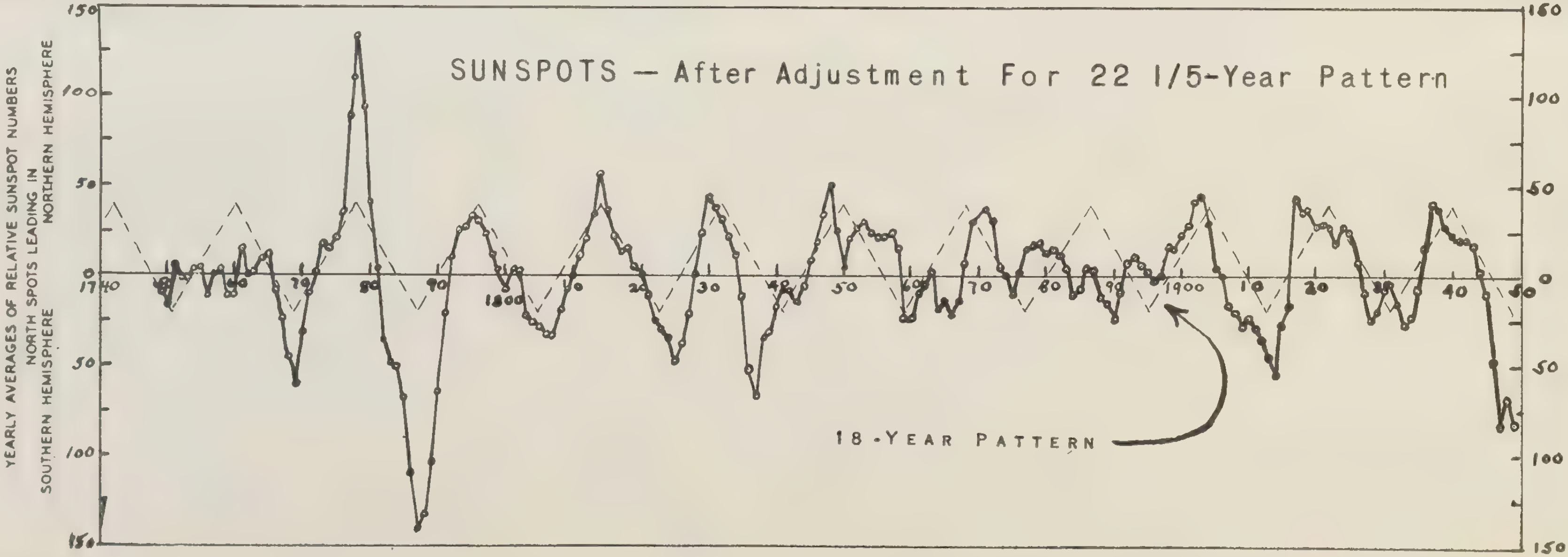


FIG. 3. YEARLY AVERAGES OF MONTHLY RELATIVE SUNSPOT NUMBERS, 1749-1949, ALTERNATE CYCLES REVERSED (AFTER ANDERSON), AFTER ADJUSTMENT FOR THE EFFECT OF THE 22 1/5-YEAR CYCLE. BROKEN LINE ADDED TO DIAGRAM THE 18-YEAR RHYTHM.

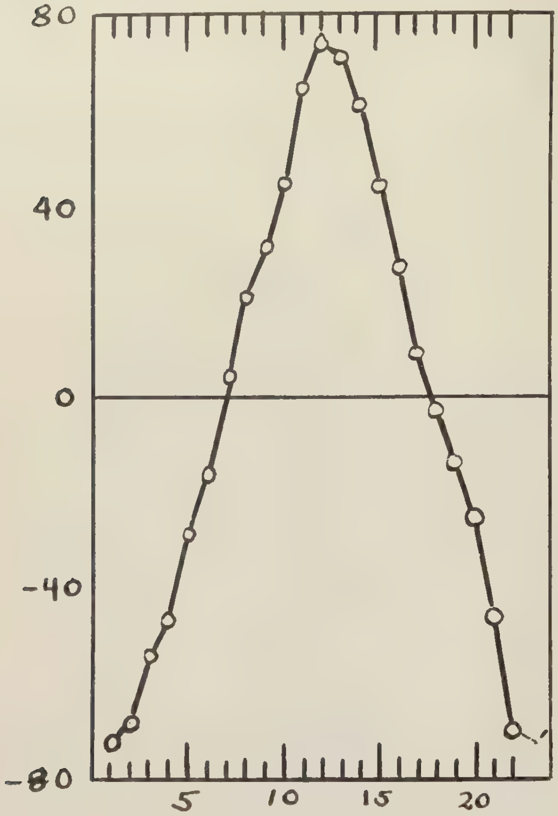


FIG. 2. THE AVERAGE 22-1/5-YEAR WAVE IN RELATIVE SUNSPOT NUMBERS, ALTERNATE CYCLES REVERSED. 1749-1947. NEGATIVE SIGNS USED TO DENOTE NORTH SPOTS LEADING IN SOUTHERN HEMISPHERE. HORIZONTAL SCALE REPRESENTS NUMBER OF YEARS AFTER BASE OF 1792, 1903, ETC.

broken line, a perfectly regular 18-year pattern so that you can see departures from perfect timing.

Of the eleven possible repetitions of this cycle nine show good conformity. Two, the first and the eighth, are badly distorted.

You will also note that the crests and troughs, sharp in early years, have of late shown a tendency to be flat. This suggests a compound wave. That is, the behavior suggests that instead of an 18-year wave we really have two waves, one slightly less than 18 years long, and one slightly over this length, which were together in 1780 and have since been pulling apart.

The possibility of a compound wave is further suggested by the shape of an average 18-year wave, as shown in Fig. 4. Instead of the usual zigzag shape (evidenced by the 22 1/5-year wave in Fig. 2 for example) we have the flatter top which would appear if in fact the wave were compound.

If we construct periodic tables of various lengths we find that as we reduce the length of the table the amplitude and sharpness of the average wave increase until we reach a length of about 17 2/3 years. Similarly as we increase the length of the tables the amplitude and sharpness increase until we reach a length of about 18 1/5 years. This fact gives further support to the idea that we may here be dealing with a compound wave.

Finally, the calculated 17 2/3-year wave in the sun comes at about the same time as the 17 2/3-year rhythm on earth; the calculated 18 1/5-year wave in the sun comes at about the same time as the 18 1/3-year rhythm on earth.

All of these matters will be dealt with in future memoranda. In the meantime Fig. 3 shows that, compound or not, there really has been a rhythm of the general neighborhood of 18 years in length in sunspots with alternate cycles reversed. This is a very important item of information.

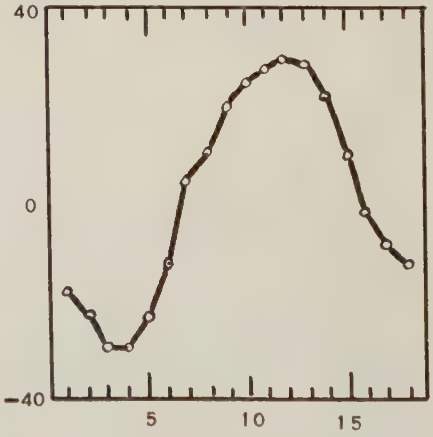


FIG. 4. THE AVERAGE 18-YEAR WAVE IN RELATIVE SUNSPOT NUMBERS, ALTERNATE CYCLES REVERSED, 1749-1947. NEGATIVE SIGNS USED TO DENOTE NORTH SPOTS LEADING IN SOUTHERN HEMISPHERE. HORIZONTAL SCALE REPRESENTS NUMBER OF YEARS AFTER BASE OF 1748, 1766, ETC.

# CYCLES IN THE STOCK MARKET

## THE 41-MONTH RHYTHM IN COMMON STOCKS

About two years ago, I distributed to our members a chart of the Dow-Jones Industrial Averages from January, 1901 to September, 1948 with a projection through 1953.

I have brought this chart up to date and reproduce it herewith on the two pages next following.

You will note that the strong upward movement starting at the middle of last year is fully in accord with the zigzag diagram projected forward by Mr. Chapin Hoskins twelve years ago in 1938, when this chart was first made.

There is no question but that since the beginning of the century there has been a tendency for common stock prices to fluctuate in general conformation to a rhythm which has averaged about 41 months from crest to crest (prior to 1900 the rhythm was somewhat shorter).

This rhythm, first remarked by Joseph Kitchin of Harvard in 1923, has continued through the 27 years since its discovery.

It seems hard for people to know how to use a knowledge of this cycle. For example, last May a woman wrote Mr. Dakin and me as follows:

Dear Sirs:

In your book **Cycles** you state that the 41-month rhythm in common stock prices is due for its next crest in July of 1950.

Because of this fact should I sell all my stocks at that time?

To this letter I replied:

Dear Madam:

It is true that behavior of the stock market from 1900 to date indicates a tendency for crests to come at time intervals that have averaged 41 months apart. It is also true that the ideal time for the next crest is July of this year.

However, the actual crests almost never coincide with ideal timing. The ideal is merely a mathematical abstraction, therefore you should not buy or sell stocks on these facts alone.

The most that can be said as a practical matter is that if the behaviors of the past continue, the odds are slightly better than 50-50 that the present crest will come somewhere between February, 1950, and December, 1950, but there is almost as good a chance that the actual crest will come somewhat outside of these limits.

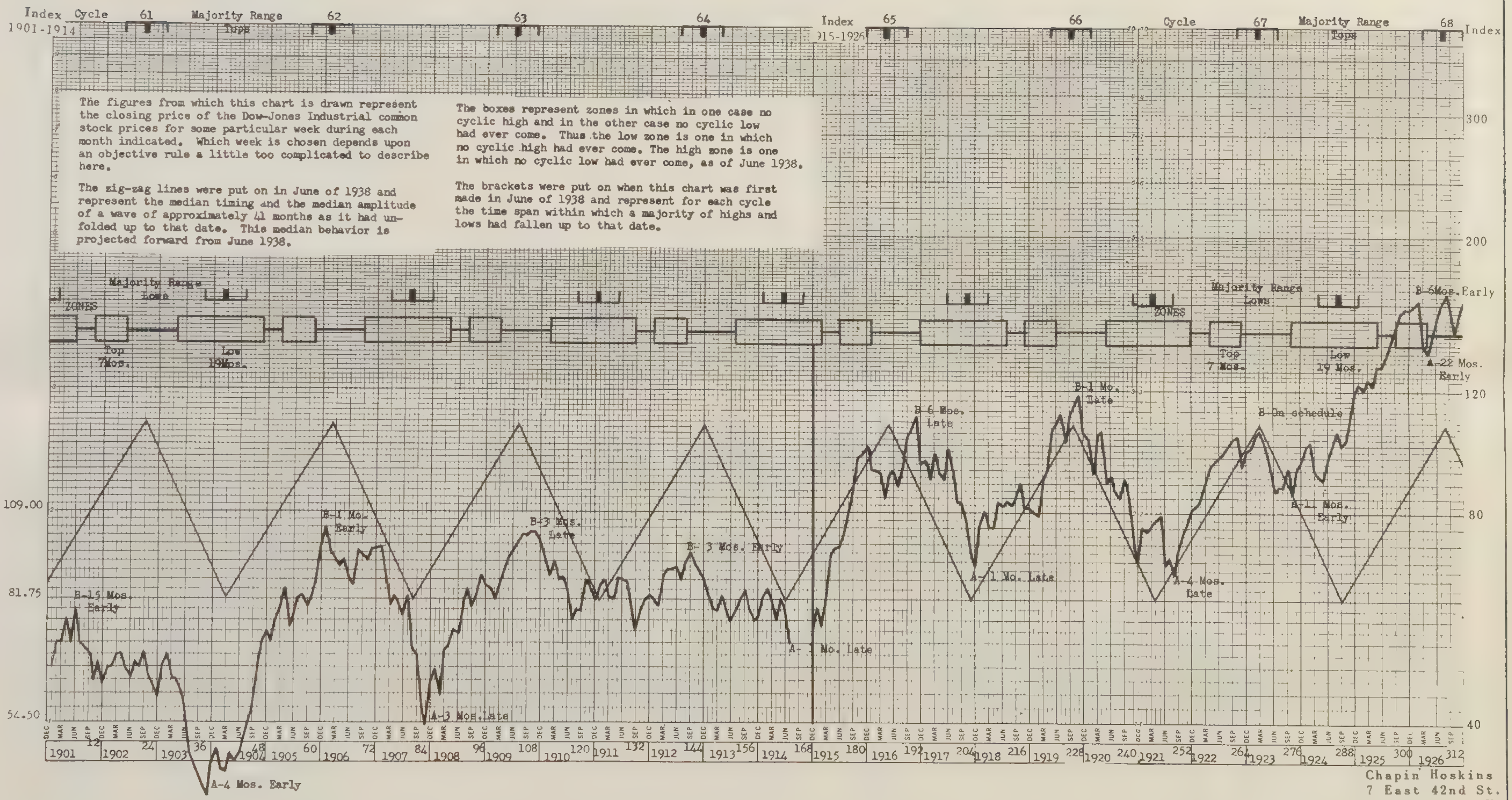
A knowledge of the 41-month cycle alone will not tell you when to expect the peak of the move except in very general terms.

On the other hand it must be admitted that if you bought stocks at the ideal time of the last 41-month low, namely August, 1948, and were to sell them now (May of 1950) you would make a very nice profit indeed, but how much longer the bull market will continue and how much more you might make if you hold them longer I do not know.

It seems to be human nature to take a chart like the one shown herewith, glue one's eye to the rigid zigzag pattern and imagine that all of one's stock market troubles are over. Or perhaps the wishful thinkers look at a crest like the one in March of 1923, which came on schedule, and ignore all the thirteen other crests which came either early or late, and often by very considerable amounts. It seems hard to adjust one's self to anything less than absolute finality.

Yet we have learned to do it with weather records and weather forecasting.

## DOW-JONES INDUSTRIAL COMMON STOCK PRICES



The figures from which this chart is drawn represent the closing price of the Dow-Jones Industrial common stock prices for some particular week during each month indicated. Which week is chosen depends upon an objective rule a little too complicated to describe here.

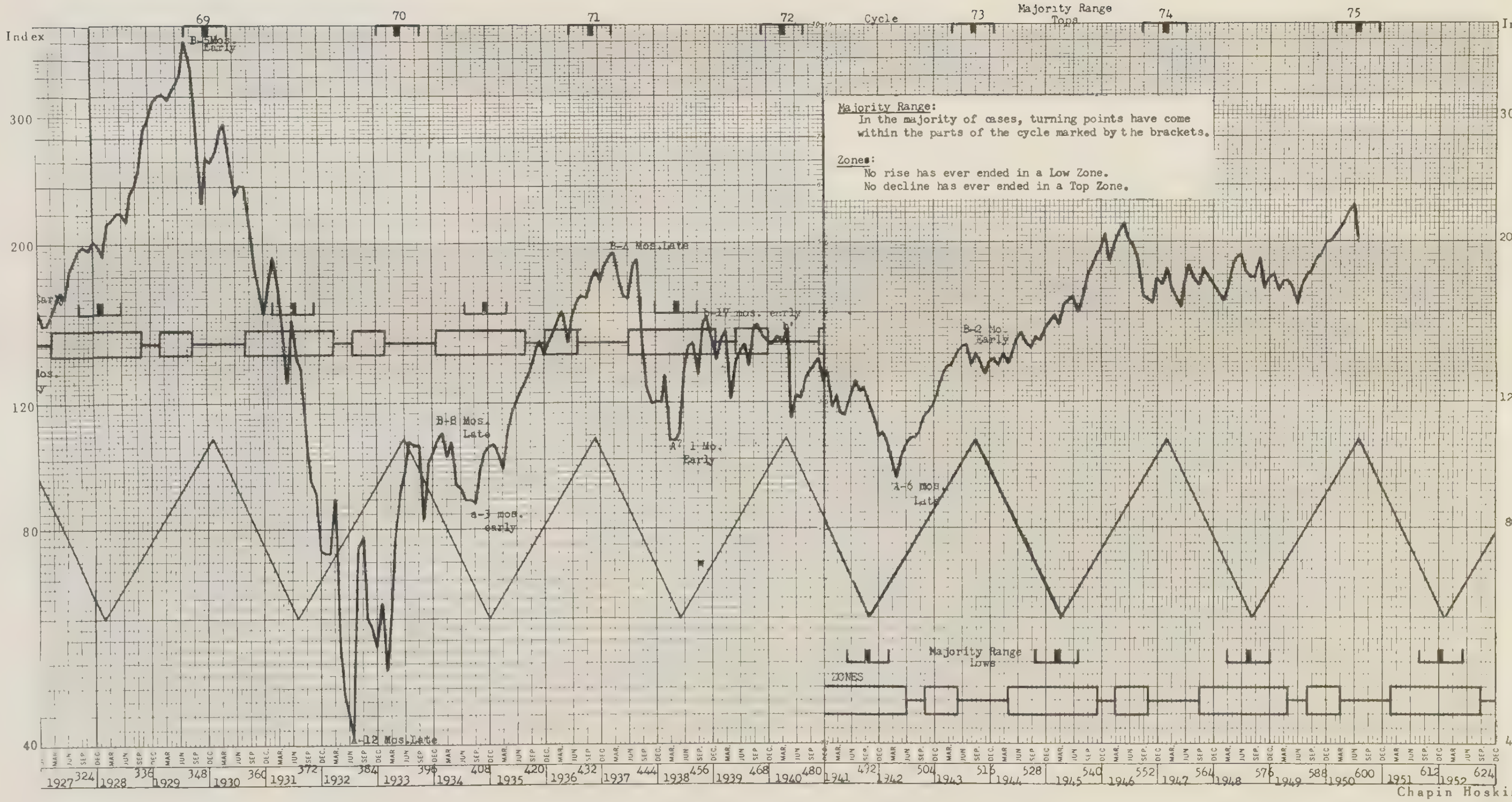
The zig-zag lines were put on in June of 1938 and represent the median timing and the median amplitude of a wave of approximately 41 months as it had unfolded up to that date. This median behavior is projected forward from June 1938.

The boxes represent zones in which in one case no cyclic high and in the other case no cyclic low had ever come. Thus the low zone is one in which no cyclic high had ever come. The high zone is one in which no cyclic low had ever come, as of June 1938.

The brackets were put on when this chart was first made in June of 1938 and represent for each cycle the time span within which a majority of highs and lows had fallen up to that date.

Chapin Hoskins
7 East 42nd St.
New York, N. Y.

# DOW-JONES INDUSTRIAL COMMON STOCK PRICES



Majority Range:
In the majority of cases, turning points have come within the parts of the cycle marked by the brackets.

Zones:
No rise has ever ended in a Low Zone.
No decline has ever ended in a Top Zone.

Chapin Hoskins
7 East 42nd St.
New York, N. Y.

We must learn to do it with economic affairs too.

If you cannot be sure of a crest in July, what can you be sure of?

1. You can be pretty sure that the crest would not be in July, for out of fourteen previous crests during this century, only one has come exactly on time.

2. You could know that if the behavior of the past 50 years continues, the probabilities are just 50-50 that the top will come within a zone which extends from three months ahead of ideal timing through four months after ideal timing--in other words somewhere between April, 1950 and November, 1950, both months inclusive.

If, however, you increase the time span to ten months so that the zone extends from February through November, you have increased the tolerances so that--if the behavior of the past 50 years continues--the odds are 8 to 6 for a crest in this area.

These odds are not to be taken too literally for 14 is not a big enough sample.

If you wish to step up the odds 11 to 3 (78½%), you would have to extend your zone to include 9 months early to 6 months late--that is, October, 1948, through January, 1951.

Probably that is as far as one should try to go in using a knowledge of the 41-month wave, i.e., that sometime in 1950 there should be a crest, and that probably this crest will be the highest point in at least 20 months (because that is characteristic of full standard highs), and that it will probably be followed by a low of similar characteristics (lower than any value for 20 preceeding months).

The high that was the latest on record during the half century was the high of February, 1934, eight months after ideal timing. This being so, perhaps one can go a little further and say that if this characteristic of highs continues, there is little chance of a high of the present 41-month cycle after April of 1951.

However, there must be a first time for everything. Up to 1934, the latest high on record in the 1900's was the high of November, 1916, six months late. Just as the high of 1934 broke the previous record, this present cycle, or any future cycle, may break the record of 1934. You must realize in all of this work we are dealing not with certainties, but with probabilities.

DEPARTURES FROM IDEAL TIMING
CRESTS OF THE 41-MONTH CYCLE
DOW-JONES INDUSTRIAL AVERAGES
JANUARY, 1901—JULY, 1950

| | |
|---|---|
| 1ST CYCLE | 9 MOS. EARLY |
| 2ND CYCLE | 1 MO. EARLY |
| 3RD CYCLE | 3 MOS. LATE |
| 4TH CYCLE | 3 MOS. EARLY |
| 5TH CYCLE | 6 MOS. LATE |
| 6TH CYCLE | 1 MO. LATE |
| 7TH CYCLE | ON TIME |
| 8TH CYCLE | 6 MOS. EARLY |
| 9TH CYCLE | 5 MOS. EARLY |
| 10TH CYCLE | 8 MOS. LATE |
| 11TH CYCLE | 4 MOS. LATE |
| 12TH CYCLE | 17 MOS. EARLY |
| 13TH CYCLE | 2 MOS. EARLY |
| 14TH CYCLE | 9 MOS. EARLY |
| 15TH CYCLE | 1 MO. EARLY (?) |

CRESTS OF THE 41-MONTH CYCLE
IN DOW-JONES INDUSTRIAL AVERAGES
RANK LIST OF DISTORTION FROM IDEAL TIMING
JANUARY, 1901—JULY, 1950

17 MOS. EARLY
15 MOS. EARLY
9 MOS. EARLY
6 MOS. EARLY
5 MOS. EARLY
3 MOS. EARLY
2 MOS. EARLY
1 MO. EARLY
1 MO. EARLY (?)
ON TIME
1 MO. LATE
3 MOS. LATE
4 MOS. LATE
6 MOS. LATE
8 MOS. LATE

# A 29½-DAY CYCLE IN THE BIRTHS OF INFANTS

Mr. Curtis Jackson, Controller of the Methodist Hospital of Southern California in Los Angeles, writes me that he has observed that the number of babies born in that hospital vary in a rhythm which corresponds to the periods of the moon.

Mr. Jackson's studies extend over a period of six years--1939 to 1944 inclusive. During this period, 5,957 babies were born in the waxing phase—new moon to full moon, and 5,050 babies were born in the waning phase—full moon to new moon.

The sample, involving as it does over 38 tons of babies, would seem to be adequate. (My secretary gagged at this method of counting babies, but it must be admitted that it constitutes a new approach!)

From these figures it is easy to compute that births during the waxing period have averaged 17.7% more numerous than births during the waning period. The yearly totals are given below:

| Year | Waxing Period | Waning Period | Difference, Waxing Over Waning | Percent, Waxing Over Waning |
|---|---|---|---|---|
| 1939 | 770 | 614 | 156 | 25.4 |
| 1940 | 769 | 687 | 82 | 11.9 |
| 1941 | 933 | 787 | 146 | 18.6 |
| 1942 | 1,283 | 1,156 | 127 | 11.0 |
| 1943 | 1,203 | 957 | 246 | 25.7 |
| 1944 | 999 | 849 | 150 | 17.7 |
| | 5,957 | 5,050 | 907 | 17.7 |

In a letter dated April 28, 1950, Mr. Jackson states, 'As a check on this study I again started tabulating births January, 1949, and have found approximately the same results to date.'

The actual figures for each lunar period are given in Table 1 and charted in Fig. 1. Births during waxing periods are shown by solid blocks, births during waning periods are shown by open blocks. The rhythmic nature of the variation is clearly evident, most of the solid blocks being above the adjoining open blocks.

What could be the reason for such behavior? Does it imply a cause and effect relationship between the moon and amorousness and/or fertility? Or is there a rhythm of just this length in one or both of these phenomena merely by accident? Or is there some other explanation?

The answers to these questions lie in the field of medicine and outside of the field of the science of cycles. A knowledge of cycles can do no more than pose the problem. Physical and experimental science must provide the answers.

In a few cases the rhythm is broken, the open blocks (waning phase) being higher than the adjacent solid blocks (waxing phase). Can we account for these distortions?

Some of the distortions would seem to have possible explanations. For example, the fourth waning phase (open block) from the right in the years 1940, 1942, 1943 and 1944 come just about nine months after the Christmas-New Year parties of 1939, 1941, 1942, and 1943 respectively. (In 1938 and 1941 the period of Christmas and New Year festivities coincided with the waxing phase of the moon, and the period nine months late shows no distortion.) There might be explanation for some of the other distortions if one knew local situations, but it is not necessary to explain all discrepancies in order to be convinced that any rhythm of this magnitude and regularity is real.

In connection with distortions one point will come to your mind at once, and that is the 14-28 day cycle of amorousness of women.

If the cycle of births reported by Mr. Jackson has anything to do with amorousness and if women have a 14-28 day cycle of such feelings, as seems to be well

FIG. 1

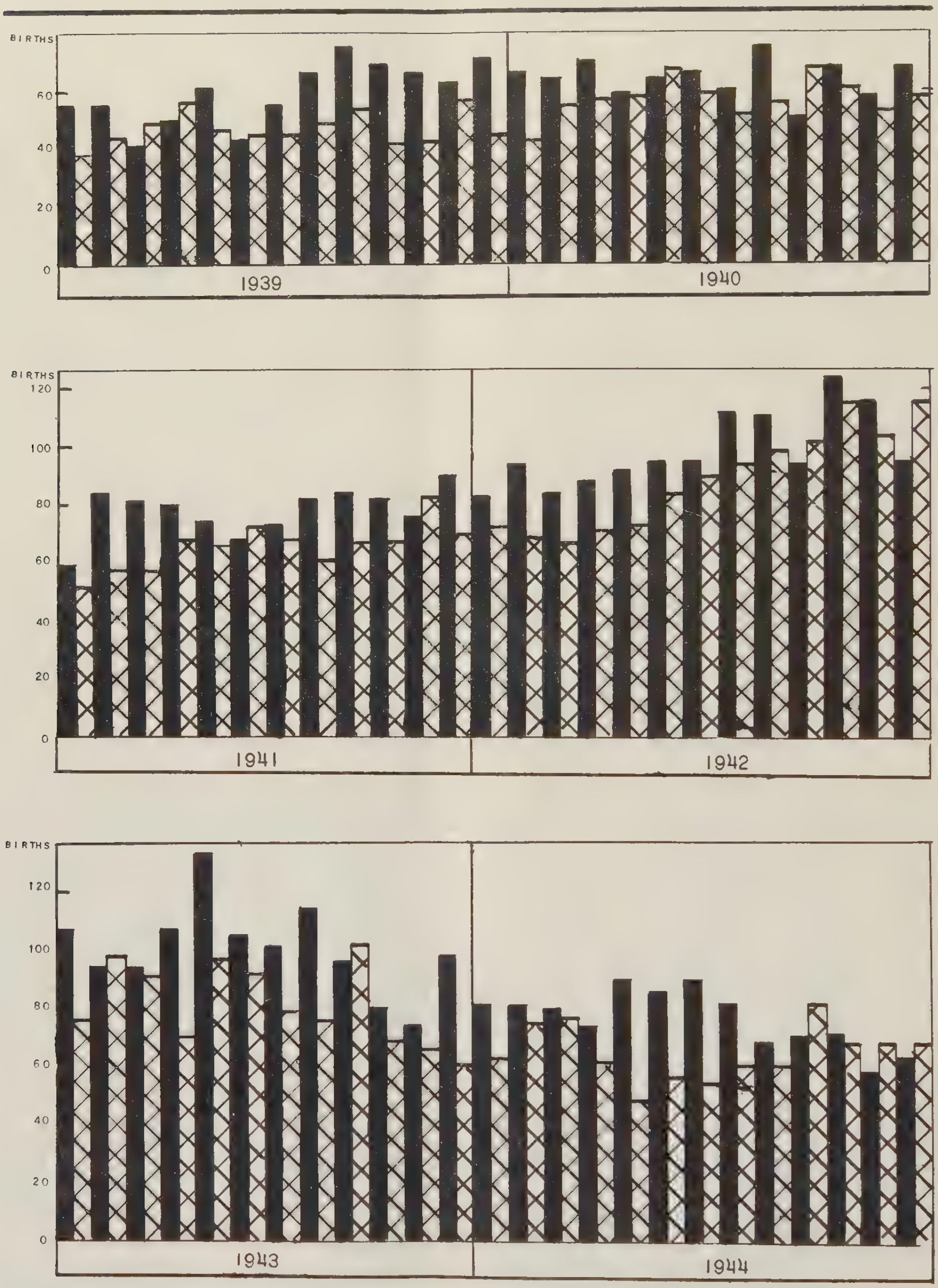
CHART SHOWING BIRTHS OF INFANTS

NEW MOON TO FULL MOON AND FULL MOON TO NEW MOON

METHODIST HOSPITAL OF SOUTHERN CALIFORNIA

1939—1944

SOLID BARS SHOW NUMBER OF BIRTHS BETWEEN THE NEW MOON AND THE FOLLOWING FULL MOON
OPEN BARS SHOW NUMBER OF BIRTHS BETWEEN FULL MOON AND THE FOLLOWING NEW MOON



established, every year and a half or so the two cycles would be in phase with each other and supplement each other, and half way between they would offset each other and tend to cancel each other out.

Before you stop to think, you might look for such a fading out in Mr. Jackson's figures, but a moment's reflection will indicate that although this result might be true for any individual woman, it would not be true for women in the mass, as each woman has her own personal timing for the 14-28 day rhythm, and these personal timings would cancel each other out in mass data. Therefore, upon reflection it is clear that regardless of the cause of the behavior noted by Mr. Jackson, no 14-28 day cycle of amorousness in individual women would have any effect upon his figures.

Lunar effects upon terrestrial affairs are frequently alleged. Are they true?

In a very interesting article entitled 'Cosmic Rhythms' published in the Winter 1941 issue of **Bio-Dynamics**, J. Schultz reports that 'Schuster established that a considerably greater number of thunderstorms occur during the waxing phase of the moon than during the waning phase.'

He also reports that 'Dr. W. Buehler investigated 33,000 births, [115 tons!] from the years 1927 to 1935 in the city of Freiburg in Bavaria and established the existence of a 29.5-day wave of births which parallels the phases of the moon. There is an increase in male births during the waxing phase and an increase of female births during the waning phase.'

He also states, 'According to observations in the tropics the phases of the moon should be taken into consideration when timber is to be felled. These observations reveal that timber felled at the time of the waxing moon is too full of sap and invites the death-watch beetle, so that it is more quickly eaten away. In South America and on the South Sea Islands contracts frequently stipulate that wood is to be cut only when the moon is waning.'

Unfortunately, Schultz gives no references to substantiate his statements and without citations, one is always a bit leary of swallowing anything hook, line, and sinker. Somewhere along the line there might be some moonshine in it! But Mr. Curtis Jackson gives actual figures. One cannot argue with them.

TABLE 1

| A NUMBER OF BIRTHS WAXING PERIOD (NEW MOON TO FULL MOON) | B DATE OF FULL MOON | C NUMBER OF BIRTHS WANING PERIOD FULL MOON TO THE FOLLOWING NEW MOON | A CONT'D. | B CONT'D. | C CONT'D. | A CONT'D. | B CONT'D. | C CONT'D. |
|---|---|---|---|---|---|---|---|---|
| | 1939 | | | 1941 | | | 1943 | |
| 55 | Jan. 5 | 38 | 59 | Jan. 13 | 51 | 107 | Jan. 21 | 76 |
| 55 | Feb. 3 | 44 | 84 | Feb. 11 | 57 | 94 | Feb. 19 | 98 |
| 41 | Mar. 5 | 49 | 81 | Mar. 13 | 57 | 94 | Mar. 21 | 91 |
| 50 | Apr. 3 | 56 | 80 | Apr. 11 | 68 | 107 | Apr. 20 | 70 |
| 61 | May 3 | 47 | 74 | May 11 | 66 | 133 | May 19 | 77 |
| 43 | June 1 | 45 | 68 | June 9 | 72 | 105 | June 17 | 92 |
| 55 | July 1 | 45 | 73 | July 8 | 68 | 101 | July 17 | 79 |
| 66 | July. 30 | 49 | 82 | Aug. 6 | 61 | 114 | Aug. 17 | 76 |
| 75 | Aug. 29 | 54 | 84 | Sept. 5 | 67 | 96 | Sept 13 | 102 |
| 69 | Sept. 28 | 42 | 82 | Oct. 5 | 67 | 80 | Oct. 13 | 69 |
| 66 | Oct. 27 | 43 | 76 | Nov. 3 | 83 | 74 | Nov. 11 | 66 |
| 63 | Nov. 26 | 57 | 90 | Dec. 3 | 70 | 98 | Dec. 11 | 61 |
| 71 | Dec. 26 | 45 | | | | | | |
| | 1940 | | | 1942 | | | 1944 | |
| 66 | Jan. 24 | 43 | 83 | Jan. 2 | 72 | 81 | Jan. 10 | 63 |
| 64 | Feb. 23 | 55 | 94 | Feb. 1 | 69 | 81 | Feb. 8 | 75 |
| 70 | Mar. 23 | 57 | 84 | Mar. 2 | 67 | 80 | Mar. 9 | 77 |
| 59 | Apr. 21 | 58 | 88 | Apr. 1 | 71 | 74 | Apr. 7 | 62 |
| 64 | May 21 | 67 | 92 | Apr. 30 | 73 | 90 | May 7 | 49 |
| 66 | June 19 | 59 | 95 | May 28 | 84 | 86 | June 6 | 57 |
| 60 | July 19 | 52 | 95 | June 28 | 90 | 90 | July 5 | 55 |
| 75 | Aug. 17 | 56 | 112 | July 27 | 94 | 82 | Aug. 5 | 61 |
| 51 | Sept. 16 | 68 | 111 | Aug. 25 | 99 | 69 | Sept 2 | 61 |
| 68 | Oct. 16 | 61 | 94 | Sept. 24 | 102 | 71 | Oct. 1 | 82 |
| 58 | Nov. 14 | 53 | 124 | Oct. 23 | 115 | 72 | Oct. 31 | 69 |
| 68 | Dec. 14 | 58 | 116 | Nov. 22 | 104 | 59 | Nov. 29 | 69 |
| | | | 95 | Dec. 22 | 116 | 64 | Dec 29 | 69 |

# WHOLESALE PRICE CYCLES

## THE 22-YEAR CYCLE IN WHOLESALE PRICES

In discussing sunspots with alternate cycles reversed in the June issue of **The Director's Letter**, I told you of a 22-year cycle in wholesale prices diagrammed in **Business Cycles** by Professor Joseph A. Schumpeter of Harvard.

In view of the correspondence in time span and timing between the major sunspot cycle and the wholesale price cycle reported by Schumpeter, a good deal of interest has been expressed in his wholesale price curve.

With the permission of the McGraw-Hill Book Company I am reproducing Professor Schumpeter's diagram herewith.

You will find this chart on page 469 of Volume II of Schumpeter's classic. In the appendix (pp. 1054-55) he describes it as follows:

'**Chart IX, arithmetic scale.** The original data (dots) are annual wholesale prices in the United States, 1790-1920, from the **U. S. Department of Agriculture Bulletin 999**, p. 2, the 5-year average, 1909-1914, being equal to 100. (1) A 3-year on a 2-year moving average (graphically determined). (2) Curve through inflection points of 10-year cycle. (3) Curve through inflection points of 22-year cycle. (4) Curve through inflection points of 50-year cycle.'*

It would be interesting to bring this chart up to date and to continue it back through 1749 by use of the Warren and Pearson Index, or even back to 1720 by Dr. Herman Stoker's Index. Such additional work would give us 100 additional years, or enough time for nearly five more cycles.

At some golden time in the future when days have 40 instead of 24 hours, I shall do this work to see if the cycle continues as we go backward and forward in time. With all those extra hours, I might even make a more exact determination of length, phase, shape, and regularity than Professor Schumpeter made in his freehand diagram. But for the present you will have to get along with Schumpeter's diagram unless you yourself wish to do the work necessary to elaborate it.

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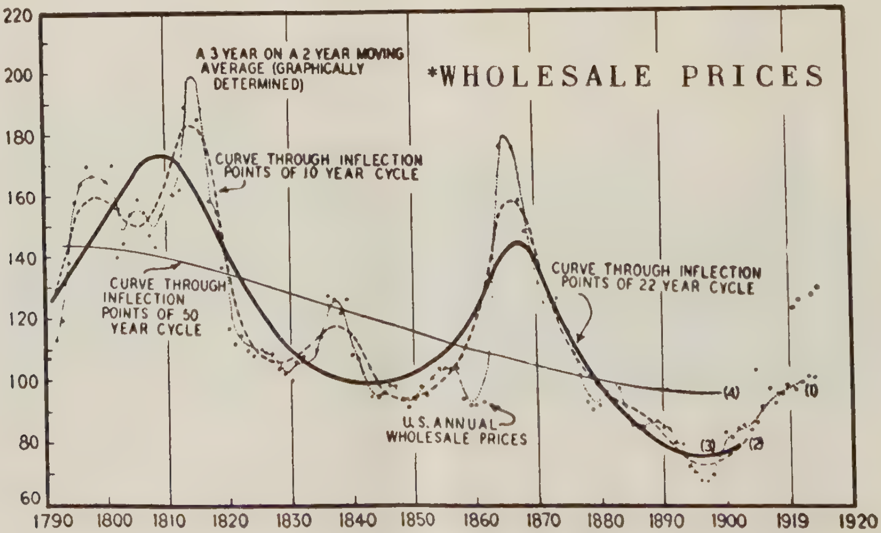
*From **Business Cycles**, Vol. II, by Joseph A. Schumpeter. Copyright 1939. Courtesy of McGraw-Hill Book Co.



# Technical

## CYCLE ANALYSIS

### HOW TO GET HINTS OF CYCLES

In Two Parts - Part I

To make a cycle analysis of a series of figures, you must do four things: First you must get a hint of a cycle that may be present. Second, you must find out all you can about this cycle. Third, you must come to an opinion in regard to the significance of the cycle and accept it as a probable reality, or reject it as probably due to random forces. Fourth, you must see if there is a hint of another cycle present, and if so, you must go through the same steps all over again. This process must be continued until all the important cycles present have been discovered, studied, characterized, and evaluated. You have now completed your cycle analysis.

If, following your analysis, you adjust the original figures for the combined effect of all the accepted cycles, the remainder will be a combination of the trend and the sporadic or non-cyclic fluctuations (including in this category the unimportant cycles, if any). To these figures you can fit a trend which you can project with due caution. You can then 'wrap' the discovered and accepted cycles around this trend to show what will happen, except for non-cyclic fluctuations, if the trend and cycles continue as determined.

You will recall that your first step is to get a hint of the cycles that may be present. How do you do this?

At the Institute held at Foundation Headquarters from June 5th to June 10th, we discussed fifteen of the ways in which this can be done. We also discussed types of machines that have been found useful in minimizing computation.

An outline of this part of the work of the Institute follows:

HOW TO GET HINTS OF CYCLES
THAT MAY BE PRESENT
IN A SERIES OF FIGURES

Graphic Methods

1. Simple inspection
2. Quick count
3. Graduated rule
4. Time chart analysis

Computational Methods

5. Limited data
6. Autocorrelation
7. Relatives: (a) simple; (b) complex
8. Moving averages
9. Section moving average: (a) simple; (b) weighted
10. Elimination of trend: (a) by comparison of the data with their moving averages; (b) by other means
11. Comparison of one moving average with another
12. Periodic tables
13. Harmonic analysis: (a) simple, and (b) multiple
14. Adjust for cycles already found
15. Dr. Norbert Wiener's methods

Machines

1. Optical machines
2. Mechanical machines
3. Electrical machines
4. Punch card and tabulating machines

It may prove of value to you if this outline is expanded.

I feel somewhat apologetic about giving you merely a brief description of the different methods, for at the Institute we spent up to two hours apiece in developing and describing each of the nineteen headings listed above, but space limitations prevent an adequate treatment in this letter. As far as I can, I will make up for this deficiency by giving you references, and as soon as possible, I will write Technical Bulletins to cover each of the methods or will get someone else to do so.

## GRAPHIC METHODS

1. You should chart the figures (usually on semi-log paper). When this has been done you can often pick out the rhythms by **simple inspection.**

2. You can make a **quick count** of the time intervals between successive crests (or troughs) on the chart thus: Crest; 1, 2 3, 4, 5 crest; 1, 2, 3, 4, 5 crest; 1, 2, 3, 4 crest; 1, 2, 3, 4, 5 crest; etc. This method will often disclose crests (or troughs) coming at more or less regular intervals. Such disclosures can be used as a basis for further study. In the example given you could see if the tendency for crests to come at five unit intervals continued throughout the rest of the series of figures.

3. You can make a series of **graduated rulers** scaled off at various uniform intervals and slip them back and forth upon the chart. These rulers can be made of paper. This method will often give hints of rhythms that escape observation by either of the methods named above. Be sure to look for both highs and lows.

4. You can compute the clearspan numbers and make a **time chart analysis.** This method is explained fully in Technical Bulletin No. 3, issued by the Foundation last year. To my mind the Hoskins Time Chart is the easiest and best way to get hints of rhythms when a chart of the figures does not show the rhythms by simple inspection as suggested by methods 1, 2, and 3 above. It is also a very valuable way to check the regularity of the cycles suggested by other methods.

## COMPUTATIONAL METHODS

5. The simplest of the computational methods is one brought to my attention by Boynton Hartz of Detroit which he calls the **limited data method.** This method involves reducing excessive fluctuations of the data on the theory that sporadic fluctuations of great magnitude are necessarily the result of random forces, or of combinations of cycles in addition to the cycle for which one may be seeking.

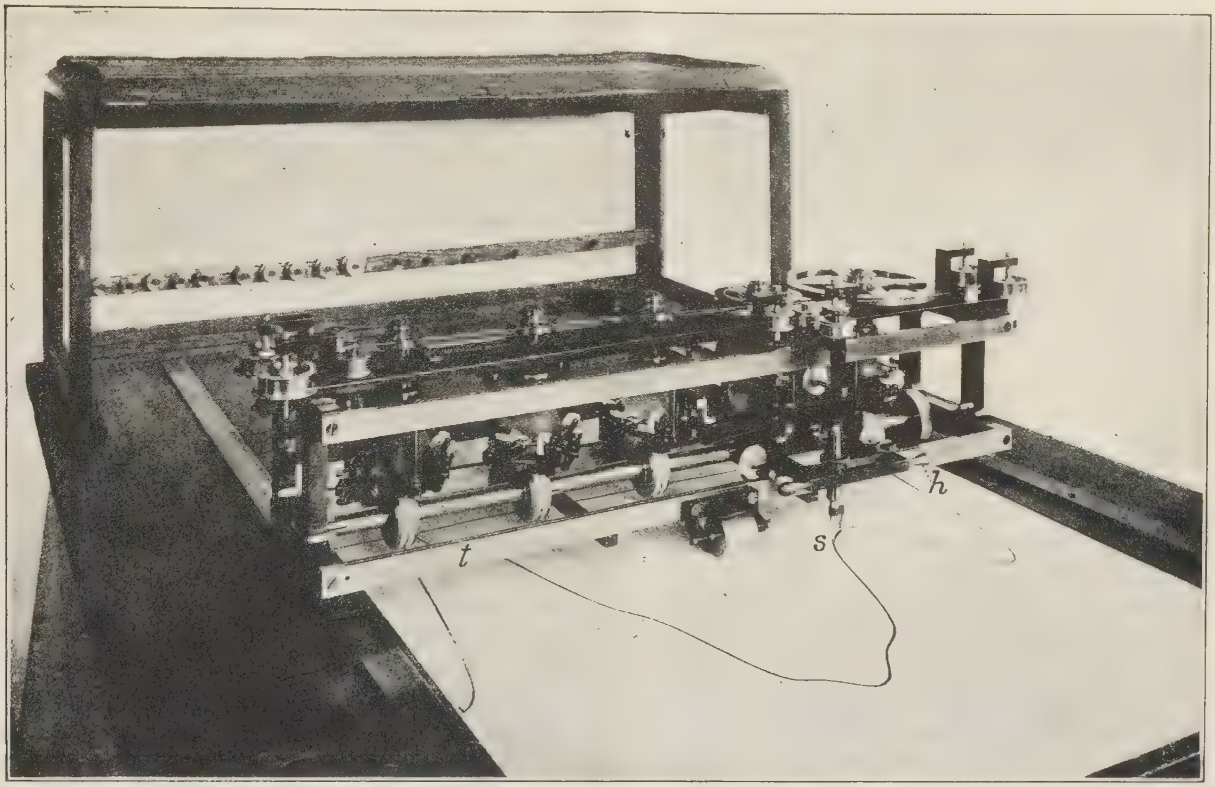
The method involves ranking the moves both up and down and arbitrarily reducing all the extremes in each array to the value of the ninth (or some other) decile.

It can be argued that any such distortion of the series distorts the values and therefore invalidates the conclusions. Of course the method creates distortions, but remember that all we are doing at this point is seeking **hints** of waves. The hints thus obtained must subsequently be verified in other ways. A treatment of these other ways is beyond the scope of this outline.

6. Another method is called **autocorrelation**, which means merely the serial correlation of a curve with itself. You can get a fairly complete description of autocorrelation in **The Analysis of Economic Time Series** by Harold T. Davis, published by the Principia Press of Bloomington, Indiana, in 1941.

7. One way to bring hidden cycles into relief is the computation of **relatives.** There are two kinds of relatives, one called **moving percentages**, the other called **moving differences.** Which to use depends upon the nature of the series being studied.

Relatives always involve a comparison of each point on the curve with another point or points on the curve a fixed distance away. (For example, comparing the sales of January of this year with the sales of January of last year, the sales



HENRICI'S HARMONIC ANALYZER
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of February of this year with the sales of February of last year, and so on.)

To learn more about relatives, you may want to get hold of **Direct Methd of Determining Cyclical Fluctuation of Economic Data**, by M. A. Brumbaugh, Prentice Hall, 1926.

Relatives must always be referred to in such a way as to indicate the time interval of the comparison and whether or not the comparison is made by subtraction or division.

One-item moving differences are ordinarily referred to as 'first differences;' 'second differences' however are not two-item moving differences, but are one-item moving differences of one-item moving differences.

The effect of relatives is to eliminate waves of the length of the relative and of all its aliquot parts (that is, one-half, one-third, one-fourth, etc.), provided of course, that the wave is uniform as to period, shape, and amplitude. Relatives also magnify waves in the general neighborhood of twice their length.

In using relatives you should realize that every excessively low or excessively high value, whether random or not, creates an important reflection in the opposite direction in your relative series at just the length of the relative away. This fact tends to create the appearance of waves just twice the length of the relative, but if the points thus reflected come at random intervals, there will not be a tendency—except by accident—for these points to be in any regular phase relationship with each other.

**Complex relatives** were invented independently by W. C. Yeatman of Los Angeles and G. T. Lane of Rochester. I told you about them briefly in my letter for June.

8. The simplest way for you to minimize the minor rhythms and the minor random fluctuations is to smooth the data by means of a short term **moving average**. (You will find many details in regard to moving averages in the Foundation's Technical Bulletin No. 4.) When you effect such a smoothing, the longer rhythms, originally obscured by the short term movement, very often stand out clearly.

Using moving averages of different lengths will help you to see rhythms of various lengths. That is, if you smooth by means of a short-term moving average you will be helped to find rhythms of medium length; if you smooth with moving averages of medium length, you will be helped to find long cycles.

Having smoothed the original figures by means of a moving average, you can subject the smoothed figures to inspection or time chart analysis, or any of the other methods for obtaining hints in regard to the length of possible cycles.

At this point I should warn you that cycles can be found even in random numbers. This is particularly true if you compare groups of random numbers, as you do when you look for cycles in smoothed figures. Obviously one group of random numbers is almost certain to be larger than another group. It is no great trick to vary the grouping (by means of taking moving averages of various lengths) in such a way that some of the high and low groups will fall into rhythmic patterns. Of course, such patterns in random numbers are not significant, but while they last they look like cycles and in fact are cycles—only they are cycles that have been created by accident and not by a constant underlying force that can be expected to continue.

It is worth pointing out that it is not the moving average that **created** the cycle. The cycle was already there (in the figures taken as groups); the moving average merely revealed it more clearly.

If you wish a mastery of moving averages as used in cycle analysis, you will be helped if you (a) make up for yourself a simple series of figures that go up and down regularly, such as 8 7 6 5 4 5 6 7 8 7 6 5 4 5 6 7 8.....and take various moving averages of it, charting both the wave and each of the moving averages; (b) make up a number of such rhythmic series of figures and subject each of them to the same moving average, plotting each of the waves and the corresponding moving average, and (c) get hold of or make up different sorts of random series of figures and subject them to different moving averages, plotting both the random series and their moving averages.

9. The **section moving average** as I call it, is also a useful tool for finding hidden periodicities and for separating one cycle from another. It is described briefly in Appendix III of **Cycles--The Science of Prediction** by Mr. E. F. Dakin and myself.

The **weighted section moving average** is an improvement upon the simple section moving average. It was devised by Mr. Lane and was also described briefly in my June letter.

Space limitations prevent consideration of the other methods in this issue of **Cycles—A Monthly Report for September.** The remaining methods and the section on machines will appear next month.

## HOSKINS STANDARD MONTH NUMBERS

On the following page are given Hoskins Standard Month Numbers from January, 1901 through December, 1960. The month number of December in each year is twelve times the last two digits of the year number. I find these numbers almost indispensable in cycle analysis.

## HOSKINS STANDARD MONTH NUMBERS

| YEAR | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEP. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1902 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 1903 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 1904 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 1905 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 1906 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
| 1907 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 |
| 1908 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 |
| 1909 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 |
| 1910 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 1911 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 |
| 1912 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 |
| 1913 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 |
| 1914 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 |
| 1915 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 |
| 1916 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 |
| 1917 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 |
| 1918 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 |
| 1919 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 |
| 1920 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 |
| 1921 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 |
| 1922 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 |
| 1923 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 |
| 1924 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 |
| 1925 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 |
| 1926 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 |
| 1927 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 |
| 1928 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 |
| 1929 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 |
| 1930 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 |
| 1931 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 |
| 1932 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 |
| 1933 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 |
| 1934 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 |
| 1935 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 |
| 1936 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 |
| 1937 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 |
| 1938 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 |
| 1939 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 |
| 1940 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 |
| 1941 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 |
| 1942 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 |
| 1943 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 |
| 1944 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 |
| 1945 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 |
| 1946 | 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 |
| 1947 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 | 561 | 562 | 563 | 564 |
| 1948 | 565 | 566 | 567 | 568 | 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 |
| 1949 | 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 |
| 1950 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 |
| 1951 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 |
| 1952 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 |
| 1953 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 |
| 1954 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 |
| 1955 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 |
| 1956 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 |
| 1957 | 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 | 681 | 682 | 683 | 684 |
| 1958 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 |
| 1959 | 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 | 705 | 706 | 707 | 708 |
| 1960 | 709 | 710 | 711 | 712 | 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 |

# DOES A 6-YEAR MOVING AVERAGE MAKE A 6-YEAR WAVE?

What people really mean when they ask, 'Does a 6-year moving average make a 6-year wave?' is, 'When you take the deviations of some actual figures from their 6-year moving average and come up with a 6-year wave, it is possible that in some way the taking of the 6-year moving average could have created the very wave that you afterward found?'

I will admit that the same question once disturbed me, so I can sympathize with this point of view. Years ago I would say to myself, 'I know that it is accepted statistical procedure to compare figures with moving averages of the length of the rhythm that is up for study—for example, when you wish to study the 12-month or seasonal pattern, it is usual to compare the original figures with a 12-month moving average—but suppose accepted statistical procedure is wrong?'

It was only after working out a good many examples with random numbers and controlled data that I reached an understanding of the subject that is sufficient so that questions of this sort do not bother me any more.

If you find yourself confused I recommend the same procedure.

In the meantime, however, it may be helpful if I work out an example for you.

In this issue of our monthly bulletin you will read about a 6-year rhythm in the orders received by the General Electric

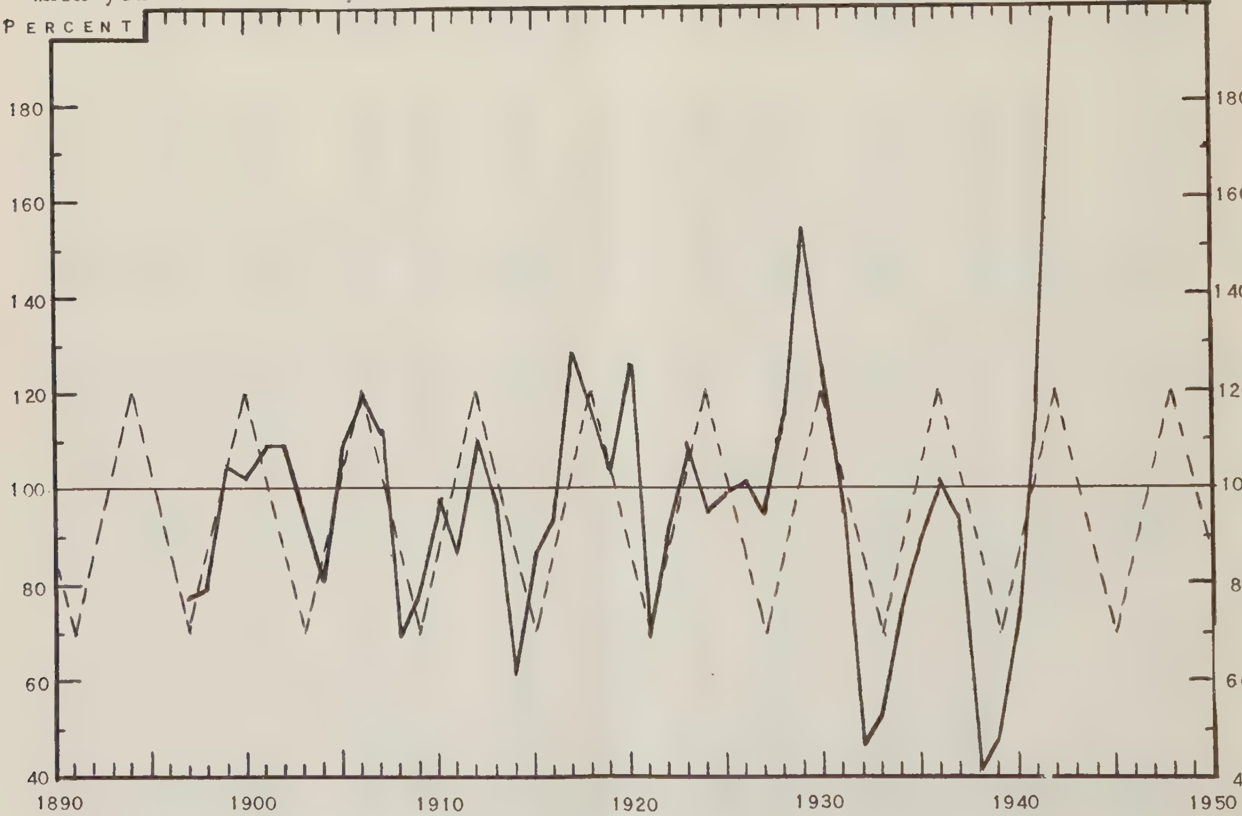

FIG. 1. THE 6-YEAR WAVE IN GENERAL ELECTRIC COMPANY ORDERS RECEIVED 1893-1946. THE DATA EXPRESSED AS PERCENTAGES OF THEIR CENTERED 9-YEAR MOVING AVERAGE. A PERFECTLY REGULAR 6-YEAR WAVE HAS BEEN ADDED BY MEANS OF A BROKEN LINE TO AID THE EYE. COMPARE WITH FIG. 1 ON P. 3.

Company, 1893 to 1946. To show this 6-year wave more clearly, I reproduced a figure from the original report. This figure shows the percentages that the actual values are of their 6-year moving average. These percentages show a 6-year wave. Could this wave in any way be the result of the 6-year moving average?

If so, then, if we had taken a 7-year, an 8-year, or a 9-year moving average, we should have gotten a 7-year, an 8-year, or a 9-year wave, should we not? Is that not good logic?

Well then, let us take a 7-year, or an 8-year, or a 9-year moving average, compare the original curve with it, and see if we obtain a 7-year, an 8-year, or a 9-year wave, or whether we find the same old 6-year wave which we obtained when we used a 6-year moving average. There is no better way to find these things out than by working out actual examples.

Which shall we take? A 7-year moving average? An 8? Or a 9?

It makes no difference, I can assure you. Let us take a 9-year moving average because it is a little easier to compute than an 8-year moving average, and a little further away from a 6-year moving average than a 7-year moving average would be. If you are not satisfied you can compute the 8-year moving average and the 7-year moving average for yourself in addition.

As you know, the first term of a 9-year moving average is computed by averaging the first nine figures of a series. The second term is computed by taking an average of the 2nd to the 10th term inclusive, and so on. The problem is worked out below, and charted in Fig. 1. The original 6-year wave shows up! Convinced?

The moving average does not create, either in itself or in the deviations from itself, a wave of its own length.

| YEAR | ORDERS | 9-YEAR MOVING AVERAGE | %. ORDERS OF 9-YEAR MOVING AVERAGE |
|---|---|---|---|
| 1893 | 10.0 | | |
| 1894 | 12.2 | | |
| 1895 | 13.2 | | |
| 1896 | 11.2 | | |
| 1897 | 14.4 | 18.6 | 77.4 |
| 1898 | 17.4 | 21.9 | 79.5 |
| 1899 | 26.3 | 24.9 | 105.6 |
| 1900 | 28.0 | 27.3 | 102.6 |
| 1901 | 34.4 | 31.6 | 108.9 |
| 1902 | 39.9 | 36.7 | 108.7 |
| 1903 | 39.1 | 41.4 | 94.4 |
| 1904 | 35.1 | 43.2 | 81.3 |
| 1905 | 50.0 | 46.1 | 108.5 |
| 1906 | 60.5 | 50.2 | 120.5 |
| 1907 | 59.3 | 53.5 | 110.8 |
| 1908 | 42.2 | 60.6 | 69.6 |
| 1909 | 54.4 | 69.1 | 78.7 |
| 1910 | 71.2 | 72.9 | 97.7 |
| 1911 | 69.8 | 80.9 | 86.3 |
| 1912 | 102.9 | 93.1 | 110.5 |
| 1913 | 111.8 | 115.9 | 96.5 |
| 1914 | 83.8 | 135.8 | 61.7 |
| 1915 | 132.4 | 154.3 | 85.8 |
| 1916 | 169.6 | 181.9 | 93.2 |
| 1917 | 246.8 | 190.5 | 129.6 |
| 1918 | 234.1 | 205.0 | 114.2 |
| 1919 | 237.6 | 229.5 | 103.5 |
| 1920 | 318.5 | 252.9 | 125.9 |
| 1921 | 179.7 | 261.0 | 68.9 |
| 1922 | 242.7 | 270.0 | 89.9 |
| 1923 | 304.2 | 278.4 | 109.3 |
| 1924 | 283.1 | 297.4 | 95.2 |
| 1925 | 302.5 | 304.9 | 99.2 |
| 1926 | 327.4 | 322.9 | 101.4 |
| 1927 | 309.8 | 323.9 | 95.6 |
| 1928 | 348.8 | 303.7 | 114.9 |
| 1929 | 445.8 | 288.1 | 154.7 |
| 1930 | 341.8 | 274.9 | 124.3 |
| 1931 | 252.0 | 262.6 | 96.0 |
| 1932 | 121.7 | 261.2 | 46.6 |
| 1933 | 142.8 | 264.6 | 54.0 |
| 1934 | 183.7 | 243.1 | 75.6 |
| 1935 | 217.4 | 245.2 | 88.7 |
| 1936 | 296.7 | 289.9 | 102.3 |
| 1937 | 379.3 | 402.2 | 94.3 |
| 1938 | 252.2 | 608.9 | 41.4 |
| 1939 | 360.7 | 739.6 | 48.8 |
| 1940 | 654.2 | 894.3 | 73.2 |
| 1941 | 1,132.8 | 955.2 | 118.6 |
| 1942 | 2,003.0 | 1,017.7 | 196.8 |
| 1943 | 1,360.6 | | |
| 1944 | 1,609.6 | | |
| 1945 | 844.5 | | |
| 1946 | 941.9 | | |

## BAGNO-WORKS CYCLE ANALYZER

For a description of the Bagno-Works 'General Integrating and Predicting Sequential Extrapolator' refer to a report on the summer meeting of the N. Y. Chapter in the section called **Foundation Affairs** on pages 29-32 of this issue.

# Foundation Affairs

## THE INSTITUTE

I have been wondering why you did not come to the Institute, held here at Foundation Headquarters from June 5th to June 20th.

Couldn't you spare the time? Was it too far away? Was the price too high? Didn't it come at the right time of year for you?

If you wanted to come but did not, please write me why, so that if possible we can change things next year to suit your convenience and necessities.

For the first Institute we had but one conferee, but he seems to have enjoyed it, judging from a letter he wrote after he got back home. With his permission I reproduce it below.

During our six days together, he and I spent about half our time in connection with ways of finding hints of rhythms, as outlined in the Technical section of this issue. The other half of the time was spent in going forward from there and actually substantiating a rhythm once a hint of it had been obtained. In connection with this part of the work we developed actual step by step procedures. We tried to make everything as practical as possible.

At the beginning of our session I told Mr. Shepard that he could quit any time he was not pleased and have his money back. I also said that if he saw it through, at the end he could, if he wished, also have all or any part of his money returned. I repeated the offer at the end of the session, but he said he was completely satisfied.

I might mention in passing that although Mr. Shepard is a Harvard Business School man, he said he had never worked so hard in any week of his life. We started work at 8:30 a.m. and worked straight through until 10:00 p.m. Then, he having said he was a night owl, I went to bed and left him with his 'homework.' Maybe it was a bit rough on him, but I did not want to have to return any of that $300! We needed it.

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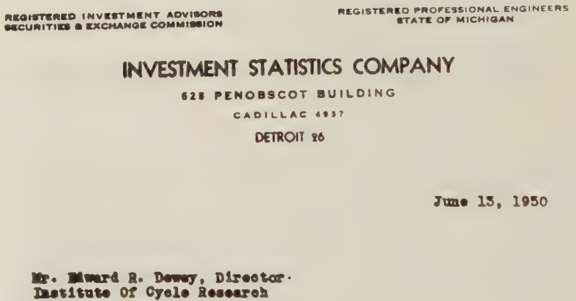

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June 13, 1950

Mr. Edward R. Dewey, Director
Institute Of Cycle Research
Riverside, Connecticut

Dear Mr. Dewey,

May I once more express to you my satisfaction with my attendance last week at your session of the Institute of Cycle Research.

Although my own training and experience in statistical research has been substantial my direct application to research on cycle analysis has been based on observation, reading and cut and try methods. The course in the fundamentals of cycle analysis which you gave me last week will be of particular value to me in correcting some erroneous ideas, expanding my resources of statistical techniques and developing a sound procedure for carrying on to success my particular project of stock price projection.

The facilities of your foundation headquarters proved to be particularly convenient and comfortable and the gracious cooperation of Mrs. Dewey was most pleasing.

May I particularly compliment you on the effectiveness of your teaching methods by systematic explanation and demonstration of principles and their use and on your continuous patience with myself as a not particularly apt student.

I look forward to being able to repeat this experience with you at another session next year.

Very Sincerely Yours,

R.L. Shepard
R. L. Shepard

RLS/te

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# SEASONAL CYCLE IN INTELLECTUAL INTEREST

If you have just joined the Foundation you may wonder why you have received nothing from us during July and August.

The reason is that experience has shown that there is a definite seasonal pattern to people's intellectual interests. In the summertime folks are simply not interested in things like cycles.

We used to send out material right through the year, but many instances arose where people had no memory of having even seen the releases of the summer months, much less read them. Finally we abandoned the year around mailing practice and limited our mailings to the ten cooler months.

Professor Ellsworth Huntington of Yale, until his death a valued member of our Board of Directors, made extensive studies to discover the seasons when people read serious books, attend scientific meetings, make highest scores on examinations, file the most amendments to patents. In all instances, he found a spring peak and an autumn peak—and a summer low. In this connection you may be interested in Figs. 44, 45, and 46, printed on this and on the following page. These charts are taken from Huntington's **Mainsprings of Civilization**, copyrighted 1945 by John Wiley & Sons and reproduced with their permission.

As you can see from these charts, you are likely to get much more out of our bulletins and reprints if we give them to you in such a way as to conform to the normal cycles of intellectual interest. What is the use of our knowing about these things if we don't do something about it?

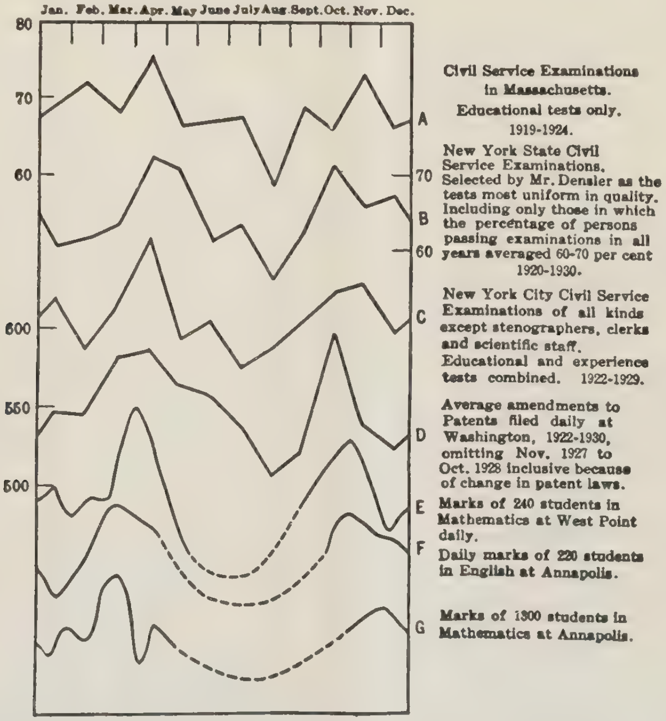

Figure 44. Seasonal Fluctuations in Mental Activity. From *Principles of Economic Geography*.

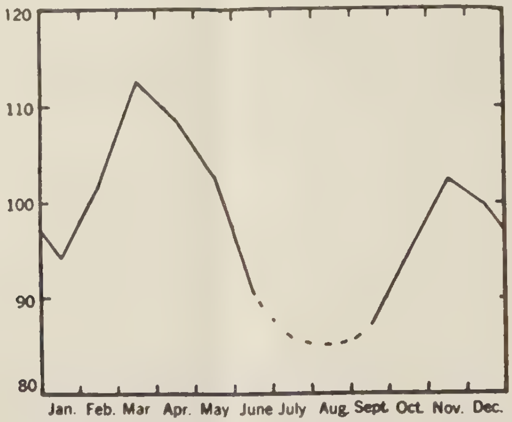

Figure 45. Average Participation in Regular Meetings of Engineering Societies. The curve is based on percentages of the weighted average of (1) The American Institute of Chemical Engineers, New York, 1893–1912, with 11.1 participants per meeting; (2) American Society of Civil Engineers, New York, 1893–1921, 4.0 participants; and (3) Western Society of Engineers, Chicago, 1900–18, 7.5 participants.

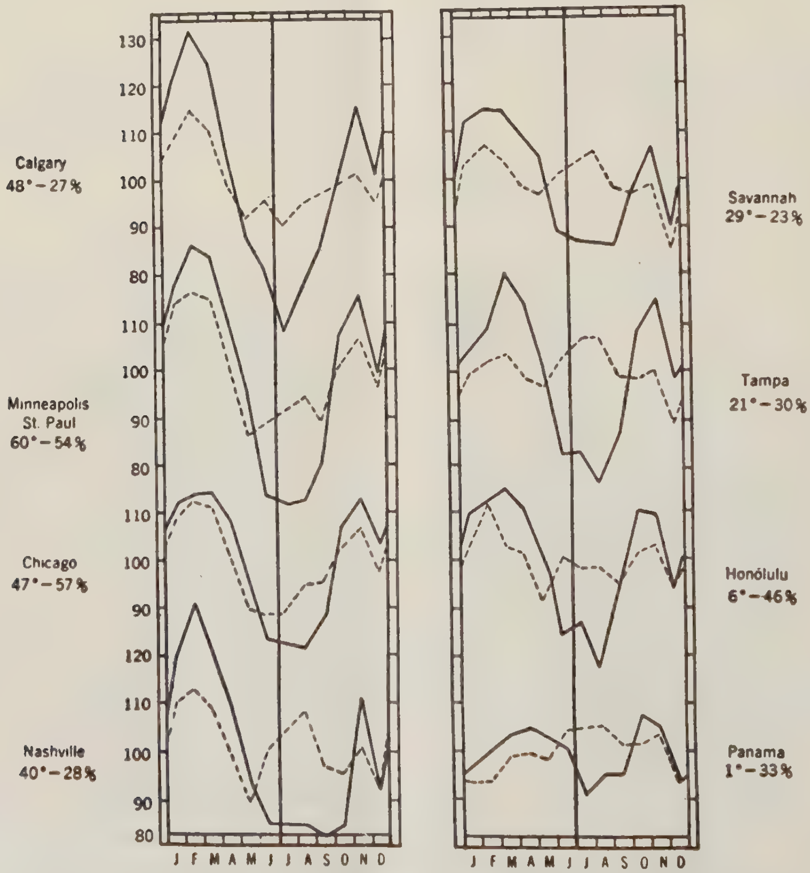

Figure 46. Seasonal Circulation of Fiction (dashed lines) and Non-fiction (solid lines) by Libraries in Eight Urban Centers. Numbers under city names indicate (1) the difference in average temperature between the warmest and coldest months, and (2) the percentage of non-fiction.

## THE JUNE MEETING OF THE NEW YORK CHAPTER

The June 27th meeting of the New York Chapter of the Foundation for the Study of Cycles was devoted to a demonstration by Mr. Charles C. Works of the Bagno-Works General Integrating and Predicting Sequential Extrapolator—'Gypsy' for short.

Through the courtesy of Committee member Dr. Harold E. Anthony the meeting was held in the Hall of Mammals at the American Museum of Natural History.

Mr. W. C. Yeatman flew on from Los Angeles expressly to attend the meeting and to see the demonstration. He was our most distant guest.

The Bagno-Works invention can most easily be described as a group of parts which can be assembled, broken down, and reassembled into four separate machines.

The first machine will make for you, and show on a screen, all possible moving averages of any given curve, one after another, as fast as you can turn a knob from left to right.

The second machine will also, at the turn of a knob, make for you and show on a screen, the deviations of any curve from each of all of its possible moving averages, and, at the turn of another knob, show the deviations of any moving average of the curve from any other of its moving averages.

The third arrangement of the equipment can compute the correlation between any two curves or between any two parts of the same curve, for any desired ranges along the curves. This correlation is a statistical measure of the extent to which two curves are composed of the same elements. It indicates the parallelism and the goodness of fit of the two curves.

The fourth machine will permit you to scan a curve for goodness of fit in comparison with each of about 2000 different standard rhythms. Having found a rhythm which fits satisfactorily, the rhythm so found can be further manipulated for goodness of fit of phase position (timing) and amplitude (height). Having obtained these results for a total of seven rhythms which show minimum difference between themselves and the original curve, at a press of a button these rhythms can be synthesized, and the synthesis projected onto a screen for comparison with the original curve. At the turn of a knob the rhythms can be projected into future or past, synthesized, and the synthesis thrown on a screen for comparison with actual future or actual past performance (in case only part of the actual curve was used for the analysis) or as a forecast, or partly one and partly the other, as you may wish.

In their present forms, the machines are working models which demonstrate the principles involved. The machines are subject to further development and improvement.

You might like to have a more extended description of the machines and their operation.

The first machine is essentially a special sort of television broadcasting machine and an ordinary oscilloscope or television receiving set. Let me explain in detail how it works. It is very simple.

The elements of the machine are diagrammed in Fig. 1. They include (A) a cathode ray (television) tube on the face of which is a silhouette of the curve to be smoothed, (B) a control box which regulates the width of a scanning beam of light which moves back and forth within the tube, and shines upon (C) the silhouette and the clear space above it, (D) an electric eye to transform the varying amounts of light which come out of the tube as the scanning beam moves back and forth into varying amounts of electricity, (E) an amplifier,

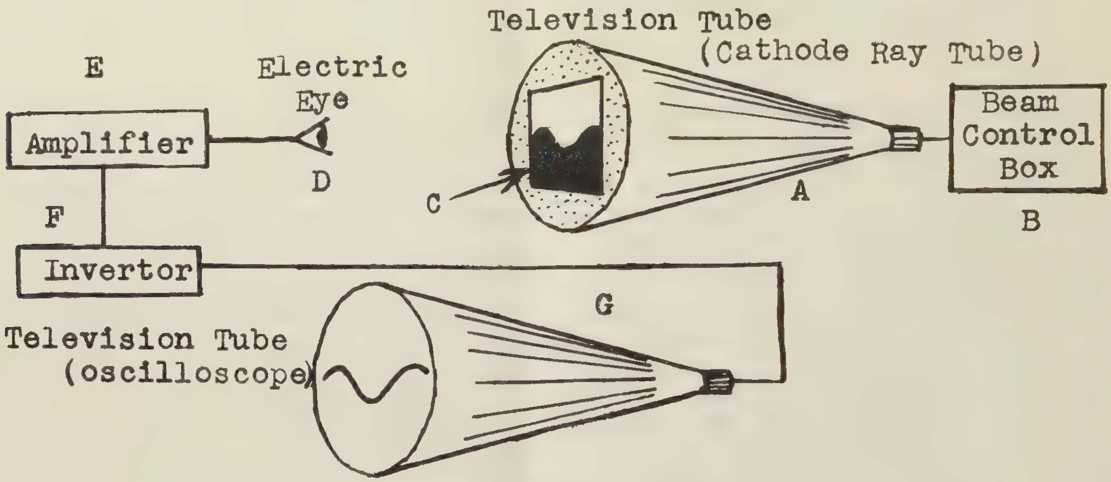

Figure 1

(F) an invertor to correct for the fact that silhouettes are black below and clear above instead of the reverse, as they should be for this purpose, and (G) an oscilloscope to record the results.

The cathode ray tube (A) is large enough to accomodate a silhouette 4" x 3¼". Such a silhouette might have 100 points, each 1/25 of an inch apart. In other words, 100 years of annual data, or 8-1/3 years of monthly data, or about two years of weekly data can be handled by the present machine at one time. Sixteen inch square tubes would have four times the capacity of the existing model.

The cathode ray tube generates a vertical beam or 'slit' of light about 1/25 of an inch wide which can move back and forth across the face of the tube.

Imagine this beam stationary at the trough of a wave as indicated by the dotted line at **a** in Fig. 2. Inside the tube this beam of light extends from top to bottom of the tube, but the silhouette cuts off about half the beam, and therefore only about half the light can get through to the electric eye . The electric eye converts this half-intensity light into half-intensity electric current.

Imagine now the beam moved to the right to position **b**. The silhouette cuts off 3/4 of the light. The electric eye converts this quarter-intensity light into quarter-intensity electricity.

Thus, as the beam of light originating at the back of the tube moves across the silhouette, the amount of light that can pass the silhouette and reach the electric eye varies in inverse proportion to the height of the curve at each of the 100 points on the curve being scanned.

That is, the higher the curve, the less light gets through and vice versa. The electric eye converts these varying amounts of light into varying amounts of electricity. When there is a trough in the wave lots of light gets through, and the eye sends along lots of electricity. When there is a peak in the curve, little light gets through and the eye sends along little electricity.

These varying amounts of electricity are now amplified. They are also rectified or turned upside down so that the amount of electricity forwarded is in direct proportion to the height at each point on the curve. These electric impulses are now sent on to the oscilloscope (G), where a line of light thrown on the face of the tube will trace the original silhouette, exactly as it appeared in (C) at the cathode ray tube (A) with which we started.

Of course, actually, the beam of light in tube A sends only one electrical impulse for each point (1/25th inch) of the silhouette, so that what you really get in tube G is a pin-point of light moving across the face of the tube. However, the point moves back and forth across the screen so fast (1/60th of a second for each round trip), that it looks like a line, and can be photographed as such.

So far you have merely reproduced the original curve. How do you compute moving averages? Very simple. Turn the knob on the beam control box (B) and widen the beam of light. If your silhouette records the events for 100 months and you widen the beam of light from 1/25 inch to 3/25 inches, the beam will give the electric eye the average value of three consecutive months. As it moves forward by 1/25 of an inch it will give the electric eye the average value of the 2nd, 3rd, and 4th months, and so on. In other words, it will give the electric eye a 3-month moving average of the data recorded on the silhouette.

If you widen the beam to 5/25 inches, you will get a 5-month moving average on the oscilloscope, and so on for every value up to 100/25 or 4 inches, at which time you will get merely a point representing the average value of the entire curve (plus, for technical reasons we need not go into here, some meaningless values on each side of it).

Thus, at a turn of the knob, as you widen the width of the beam, you can show, progressively, on the screen of the oscilloscope, every possible moving average from 1 to 100 terms in length, of your original 100 point curve. You can stop at any point you wish and study or photograph or trace any of the infinite number of moving averages between these two limits.

Let us now consider the second machine.

The second machine is made from the first one by adding an additional originating cathode ray tube and an additional electric eye as in Fig. 3. Each tube has in front of it an identical silhouette of the curve being studied.

In the cathode ray tube $A_1$ the scanning beam of light is held at 1/25 of an inch wide. From it electric eye $D_1$ picks up and transmits electrically the original curve just as with the first machine.

In cathode ray tube $A_2$ the scanning beam is widened by the beam control box $B_2$ to the width of any moving average you chose—say 9/25 inches, or 9 months if your curve represents 100 monthly values.

The electrical impulses from eye $D_1$ are reversed as before, but the impulses from eye $D_2$ are allowed to proceed upside down exactly as picked up by the eye.

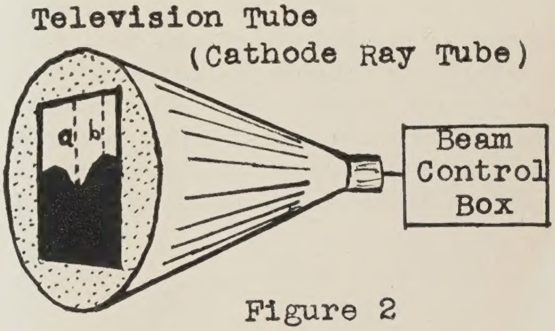

Figure 2

These two sets of impulses are combined and projected onto the oscilloscope screen G as the difference between the curve and the moving average. (If the silhouettes represent logs of the data, the projected curve will of course represent percentage variation instead of arithmetic differences.

The machine knows its algebra thoroughly, but lest you have forgotten some of yours, I should perhaps go over this last paragraph again. To subtract one number from another, all you need to do is to change sign and add algebraically (10 - 3 is the same as 10 + (-3)). As the impulses from tube $A_1$ are right side up (as a result of having passed through the invertor) and as the impulses from tube $A_2$ are fed into the circuit unrectified, or upside down, when you add them together, the composite is the algebraic sum.

As for the logarithm part of it, you doubtless remember that you can divide one number by another by subtracting the logarithms of the numbers. But even if you have forgotten, it makes no difference, for the machine is as thoroughly 'up' on its logarithms as it is 'up' on its algebra.

Finally, if you make use of beam control box $B_1$ and widen the scanning beam in tube $A_1$ you can feed electric eye $D_1$ a moving average too, and the result shown on the oscilloscope will be the comparison of one moving average with another.

The third machine is exactly the same as the second one except that the beam control boxes are not used, the two curves being scanned by a narrow beam at all times. A special meter (H) is added to the equipment to measure the average square of the differences between the currents from the two electric eyes. The meter reading gives the relative correlation, and the absolute correlation can be found by applying a simple statistical formula to the relative correlation and to the meter readings for each curve alone.

In closing let me say this of all the machines:

As I am sure Mr. Bagno and Mr. Works would be the first to agree, the machines are still in the experimental stage. Just as the early radio had static, and the early television had blurs and phantoms and distortions (and I am told sometimes they still do), these machines are only a preview of the developments possible along the lines of electronic computation. Although the time factor has been reduced in the ratio several hundred to one, human skill is still required to operate the delicate adjustments of the machine. Moreover in this early device mechanical difficulties and 'static' interfere with the accuracy desirable in work of this sort. There is much more to be done, but the distance that has been covered so far is noteworthy.

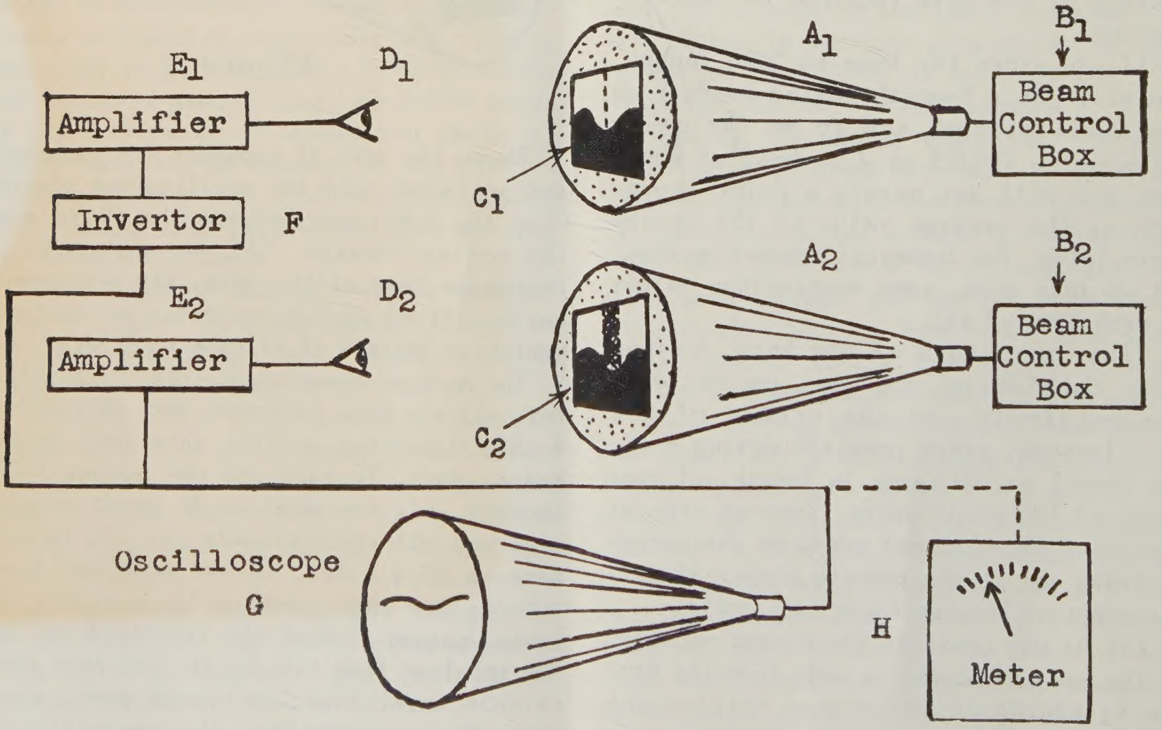

Figure 3

# THE SIGNIFICANCE OF THE SEPTEMBER REPORT

(Continued from inside front cover)

these lengths, but does no more than give a hint. The story in this issue takes the investigation up from there and shows that the cycle of about 18 years in length is **rhythmic**; that is, that it repeats time after time with a beat or degree of regularity. This story also shows, as suggested by Anderson, that the cycle may be compound.

The difference in the two approaches is the same as the difference between hearing a noise that might be a burglar, and actually seeing the burglar.

The next step is to get the burglar's name and address--that is, to make a positive identification of the cycles involved. This will be done in a forthcoming report.

The **stock market story** is important, not only for its practical application, but because the stock market is one of the best measures of psychological attitudes that I know about. It is a thermometer of mass optimism and mass pessimism. It seems to be particularly sensitive to the various rhythmic forces that we observe singly or in combination in other phenomena. It has the added advantage of not seemingly being particularly distorted by wars or other factors that often distort price and production series.

This stock market story has another interest for the cycle student. It shows how cycles keep on coming true after discovery, and how they snap back into phase after distortion. You will remember that the 41-month rhythm was announced in print in 1923 and, according to one of our members, was discovered privately as far back as 1907. It has been coming true ever since discovery.

The **baby story** illustrates one of the true functions of cycle studies--to provide clues as to possible interrelationship between phenomena so that causes can be better understood and results controlled.

The **wholesale price story** is important because it shows on earth a cycle that is so dominant on the sun. It suggests a cosmic-terrestrial link, and helps to demonstrate the usefulness of the cycle approach.

The story in the Technical section on **how to get hints of cycles** was included partly for the usefulness of having a variety of methods all included in one place. This story more or less takes the place of **Technical Bulletin No. 1**, now out of print.

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reason is getting wise by pressing buttons. If regarded this way they are like schemes for getting rich without doing any work. As for myself I have found that shortcuts are often more time consuming than the long way around.

# WHY NOT JOIN THE FOUNDATION FOR THE STUDY OF CYCLES?

If you want to keep informed in regard to developments in the field of cycles and wish to assist, your financial and moral support will be very much appreciated.

We rely entirely upon voluntary contributions.

All that is necessary is to send in your check with an indication of the class of membership you desire. $5.00 of your contribution will be applied toward a subscription to **Cycles--A Monthly Report** for one year.

☐ **Regular members** contribute $10 to $249 a year, according to their interest and means. Regular members receive letters, regular bulletins, and reprints as issued, without charge, and may buy special technical bulletins and reports at cost. When their contribution is $50 or more per year they may have consultation privileges in proportion to their contribution.

☐ **Associate members** contribute $250 or more a year, and are known as Associates of the Foundation. They receive all letters, bulletins, reprints, and reports as issued, without charge, and in addition have liberal consultation privileges.

☐ **Corporation members** contribute from $100 to $5,000 a year. Corporation members receive letters, bulletins, reprints, and reports without charge, and may have consultation privileges in proportion to their contribution.

☐ **College members** contribute from $3 to $25 a year and must be full-time students or faculty members of recognized colleges and/or universities. They receive the same benefits as **Regular Members**. Please indicate college, and class, or faculty position.

☐ **Scientific members** pay no dues, but get none of the publications. They have the privilege of buying publications at membership discount. Scientific membership is limited to persons who have published scientific papers in the field of cycles.

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